## INTERNATIONAL SCIENTIFIC CONFERENCE IN DENTISTRY 2019.

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March 29th, 2019. Contemporary diagnostic principles in dentistry I

March 30th, 2019. Contemporary diagnostic principles in dentistry II

Novi Sad, Republic of Serbia

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## PROCEEDINGS OF THE INTERNATIONAL SCIENTIFIC CONFERENCE IN

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On behalf of the Scientific Committee, I'm pleased to welcome you at the Forth International Scientific Conference in Dentistry 2019 Novi Sad.

I had the great privilege and pleasure of being among the organization team in the past meetings and the President of Scientific Committee of the current one in 2019.

The Scientific and Organization Committee have made every effort to plan a conference that is scientifically satisfactory and socially interesting.

You will meet with an exceptional program covering different topics, from basic research areas to areas within daily practice of Restorative Dentistry, Endodontics, Prosthodontics, Oral Surgery and Implantology, Periodontology, Paediatric and Preventive Dentistry. Technical and Dental Material exhibits will also form an important segment of the Conference.

Apart from the scientific aspect od the Conference we wish you to experience the traditional hospitability of Novi Sad and to strengthen the existing friendships and create a lot of new ones.

> President of the Scientific Committee Dr Milica Jeremić Knežević, assistant professor

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## **Invited lectures**

#### APPLICATION OF CONTEMPORARY TECHNOLOGIES AND COMPUTER AIDED SYSTEMS IN DENTAL PROSTHETICS

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Abstract: The rapid development of computer-aided (CA) technologies left an indelible mark on dental prosthetics. The area of dental prosthetics has introduced numerous novel technologies and methods that allow the manufacture of precision, custom-made, optimal dental replacements. During the past decade, efforts have been concentrated towards an advancement of the modelling and manufacture of dental replacements by introducing modern CA systems, state-of-the-art materials and machining technologies, as opposed to the traditional way of manual manufacture, which is prone to numerous subjective errors. Amongst modern CA systems that have found broad application in this area, the most widely used are 3D-digitization systems, CAD and reverse engineering (RE), CAM, rapid manufacture (RM) and rapid prototyping (RP). The development and implementation of such technologies and systems have paved the way towards a significant advancement in conventional modelling, manufacture and the inspection of dental replacements. Different dental substrates may have special requirements related to their modelling and manufacture. This paper focuses on the applicability and possible benefits of the application of RE and RM techniques in the design and manufacture of dental replacements and medical devices.

*Key words:* computer-aided design, computer-aided manufacturing, 3D digitisation, dental technology

#### Introduction

The first thing dental professionals think about when they hear the words digital dentistry is computer -aided design/computer aided manufacturing. That is not surprising because during the past decade extreme efforts have been made towards an advancement of the modeling and manufacture of accurate, custom made optimal dental replacements by introducing contemporary technologies and computer aided systems<sup>1</sup>. But their implementation in the workflow starts at the very beginning of the treatment. Today almost all offices have computerized system for record keeping that includes business management, inventory control, clinical efficiency, patient engagement, billing and collections, integrating digital products and records, education...As practice management software has evolved to comprise the complete management of patient records and treatment planning, it has also provided a tool for the digital archiving of patient data. Having this data at one's fingertips means that a remake of a crown can be made without a new impression being taken, for instance. In another example, reviewing abrasion or reviewing the retraction of the gingiva between two visits can be done based on digital scanning when records are kept.

In a majority of the clinical cases the diagnosis can't be imagined without digital radiography that has significant advantages. Using contemporary technologies and computer aided systems all necessary data are present to develop a patient-specific treatment plan and to present a detailed and visually appealing treatment plan to the patient. Digital technology also makes it much easier to communicate between clinicians or clinician and laboratory to finalize the details of the treatment plan. If implant treatment is performed, the opportunity arises to work with surgical guides and with pre-manufactured temporary prosthetics. CAD-CAM systems provide production of more accurate, highly biocompatible and quicker dental devices with optimal fit.

#### Computer aided systems in diagnostics and therapy planning

The use of digital radiography within dental practice has grown exponentially since its emergence in the late 1980s<sup>2</sup>. It represents one of the greatest technological advancements within the

profession. In the fields of intraoral radiography, film based systems were replaced by a photostimulable phosphor plate (PSP) that recorded information, which was "read" by a processing unit. Over time solid state detectors were introduced that eliminated intermediate stages, previously required to display an image, while maintaining the ability to enhance images on the computer screen<sup>3</sup>. This system enabled clinicians to enhance the image interactively, increasing or decreasing its brightness and hence assisting diagnosis. Similarly, solid state digital sensors are used in digital dental panoramic radiography<sup>2</sup>.

CBCT (Cone Beam Computed Tomography) is the most frequently used radiographic method for 3D visualization of the orofacial structures<sup>2</sup>. This revolutionary imaging technique has advanced dental radiography from the world of 2D to a true 3D representation of the hard tissues within a region of interest. In CBCT, the x-ray source is collimated to form a conical shape beam that is pulsed and of variable intensities<sup>2</sup>. After passing through the scanned region the beam is detected by a flat panel digital detector<sup>2</sup>. The basic construction of a CBCT unit consists of an x-ray tube and an image detector mounted on a fixed gantry. This allows for synchronous movement of both components during image acquisition. 2D images are collected. They undergo a process of 3D reconstruction (filtered back projection that involves a serious of complex programing). Collected and processed data can be displayed in their initial form as a multi- planar (MPR) image composed of isotropic voxels<sup>2</sup>. They can be of variable size depending on clinical indication. Data can be reconstructed into panoramic, lateral cephalometric-style images or surface rendered images. Data can be used to print 3D models of the scanned volume, which can be used in treatment planning or for the trying procedure before surgical or prosthodontic treatment.

CBCT data can be used for modeling of custom made bone graft in the pre-prosthetic treatment of the patient that will receive implant supported device. When there is deficiency in height and width of the residual alveolar bone, the placement of an implant of adequate length and appropriate subsequent prosthetic rehabilitation is difficult. Therefore, in certain cases a strong rigid graft is required to allow fixation to the recipient site and 3-dimensional (3D) stability to withstand muscular forces<sup>4</sup>. An autologous bone (bone derived from the patient himself) is considered to be a "golden standard" in the treatment of bone defects and partial atrophic alveolar ridge. It exhibits excellent bio absorption capabilities and is never rejected by the body. However, large defects and bone losses are difficult to restore in this manner, because the extraction of large amounts of autologous tissue can cause donor-site problems. Alternatively, data from a cone-beam computed tomographic (CBCT) scan can be used to shape a precise 3D homologous bone block using CAD-CAM system<sup>5</sup>. In this way, the bone block can be transferred directly from its sterile packaging to the receiving site without the need to be shaped<sup>6</sup>. Generating 3D model of the jaw is the first step in the graft modelling procedure. The procedure is performed according to Cone Beam CT images provided in DICOM format that enables further generation of the 3D model of patient's jaw<sup>7</sup> (Figure 1). After that input parameters, such as shape and size of the graft and its position in the jaw, should be defined. At this stage, the highest level of cooperation within a multidisciplinary team involving oral surgeons and engineers has to be accomplished to obtain a 3D graft model that would satisfy both medicoesthetic, technical and functional requirements. Upon defining the input parameters, the 3D graft modelling procedure should be performed<sup>7</sup> (Figure 2).



Fig. 1. CBCT image



Figure 2. The procedure of 3D graft modeling

CBCT imaging has become a standard radiographic method in implant treatment planning procedure. It enables planning an implant placement with a reasonable level of accuracy. 3D image of the osseous region of interest may be constructed and viewed in multiple planes. With regard to osseous architecture, the ability to visualize anatomic landmarks is high. Optimal implant position enables optimal dental device in function and esthetics. CBCT data can also be used for visualization of the position of the future dental device that is to be made. For that purpose temporary dental device with radiosensitive markers should be made and put into the patient's mouth while making CBCT image. Radiographic stent makes implant supported dental device therapy planning visualized and easier with more predictable outcome. Radiographic stent can, also, be transferred to surgical 2D or 3D stent.

#### Modern technologies and computer aided systems in dental device manufacturing

When we move on to the next phase of prosthodontic treatment we can see that modern technologies and computer aided systems are present at almost every stage of dental device production. In the phase of dental impression taking digital technology made a great influence. Intra and extra oral scanning changed the acquisition of data from analog to digital technology. It is well known that there are well developed software solutions on the market today that are offering the clinician the design of the future dental device. That makes virtual modelling process quicker and easier.

At this stage the digital technological procedure can go in two different directions: to subtractive processing or to additive manufacturing. Using those technologies we are able to overcome the shortcomings of traditional "lost wax" technique. If we look at where we are today then CAD/CAM in dentistry is primarily based on the process of subtractive manufacturing. The technology most people are familiar with is computer numerically controlled machining. It is based on processes in which power-driven machine tools are used to mechanically cut the material to achieve the desired geometry. All the steps are controlled by a computer program. It starts out with a block of the material and the machine cuts away the bits that are not wanted. Subtractive technology enabled us to use zirconia. Dental profession is less familiar with the additive manufacturing.

There are certain advantages and disadvantages of manual-analog technology, subtractive and additive technology. The manual process is time consuming, less precise, requires materials that might not provide complete accuracy and rely on steady hands and expert eyes and experience. Although subtractive technology or dental milling is very often used for dental device manufacturing it has certain disadvantages. The overall quality and ability to mill complex shapes is dependent on the number of axis used. Higher operating and maintenance costs more in the systems with 5 axis. In the production process the excess material should be removed, so it is wasteful in material usage. Additive manufacturing or 3D printing enables reproduction of complex shapes in exact detail as it was designed without waste. Curves, holes and more complex shapes can be easier and more accurately reproduced with 3D printing than with cutting. This technology is suitable for fabrication of metal framework for removable partial dentures, as their design is very complex. 3D printing does not require special strategies or use of a special parameters to compensate for the size of the cutting tool.

SLM is a promising additive technology that may enable fabrication of dental devices, overcoming some of the imperfections of casting. 3D parts are fabricated by the layered addition of material directly on the basis of computer aided design (CAD) data<sup>8</sup>. In that way, SLM enables a quick fabrication of 3D parts of any complex shape. A high power laser is used to melt a powder feedstock to form fully dense metallic parts. SLM fabricated objects are extremely dense and the mechanical properties are comparable to, or better than, those of cast or machined parts<sup>9</sup>. In dental applications, SLM is a technique that could replace conventional metal casting procedures, as it can be used as a tool for the production of customized dental parts from biocompatible alloys directly<sup>9,10</sup>.

#### Modern technologies in detection of occlusal loading

Occlusal contacts were detected for decades by the articulating paper and by occlusal markers or the proffesional was leaning on the subjectiv interpretation of the patient about the intensity of the

occlusal contacts<sup>11,12</sup>. Nowadys special sensors can be used for detection and measuring the intensity of them. It is of utmost importance in designing occlusal morphology of dental restorations, especially if they are implant supported<sup>11</sup>.

#### Conclusion

Contemporary technologies and computer aided systems are a tool for the benefit of the patient and the profession. In no way does it detract from the value of previously acquired knowledge or dental knowhow.

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## THE IMPACT OF ORAL SURGICAL AND IMPLANTOLOGICAL REQUIREMENTS ON THE COMPRESSIVE SYNDROME

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#### Abstract:

There is almost no dentist who has experienced a sense of pain, tension and tightness in cervical spine. Painful pain syndrome or tension myalgia is a disorder that affects the cervical part of the trapezium muscle.

Most of the symptoms of a painful neck syndrome are due to either injury or onsetdegenerative changes and osteoarthritis. Symptoms that may arise include:

- pain and stiffness of the back of the spine,
- piercing pain between the shoulder blades that can spread over the shoulders and / or forearms,
- numbness of the neck muscles,
- palpable neck stiffness,
- limited door movements.

Cervical pain, which is limited to the neck and shoulders, and does not continue towards the upper arms, is usually caused by an overload of muscles and ligaments. Physical therapy and conservative treatment can lead to complete disappearance of the symptoms. However, if the pain is transmitted to the upper arm, the prognosis is much more unfavorable, as this symptom indicates a nerve compression caused by herniation (rupture) of the cervical disc due to injury or the creation of arthritic osteophytes.

#### MARGINAL BONE LOSS AROUND DENTAL IMPLANTS

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*Abstract:* Long-term dental implant stability are multi-factorial. From the very beginning of implantology, the marginal loss of alveolar bone at the annual level has been recognized as one of the success indicators in dental implant therapy[1]. The aim of this presentation is to consider the factors that lead to the resorption of the alveolar bone around the implant. The factors that wll be cosider are surgical phase depending factors, prosthetic phase depending factors and patient related factors. Knowing the risk factors that lead to the loss of alveolar bone after the implant placement can help to understand risk factors and improve long term implant stability. *Key words:* dental implants, bone loss

#### Introduction

The clinical replacement of lost natural teeth by osseointegrated implants has represented one of the most significant advances in restorative dentistry. A number of surgical and prosthetic factors should be assessed during treatment planning for missing teeth. The volume and characteristics of the edentulous ridge, gingival biotype, interarch distance, occlusal scheme, implant alternatives concerning the size, number, and location of the implants, and patient expectations are the main issues that need to be addressed. For that there are some rules that every implantologist should consider in order to achieve predictable results .

This article consider some of the most important facts about marginal bone loss around implants. Alveolar bone dimensions, biotype of periodontium, implant positioning, microleakage at the implant abutment interface, excces cement in the periimplant space are some intimately related to predictable periimplant bone loss. A thin gingival biotype has a thin buccal plate. There is significantly more remodeling of the socket post-extraction and more soft tissue recession, post implant placement [3]. From a prosthetic and hygienic perspective, the implant should ideally be perfectly centered below the planned implant crown. Formation of the biologic width leads to the circumferential thinning of periimplant bone which can result in the formation of alveolar bone dehiscences, especially at sites with thin buccal bone plates. These dehisciences lead to soft tissue recessions, which are very difficult to treat and can result in the exposure of implant components [4]. To prevent such esthetic complications, ideally a facial bone thickness of 2 to 3mm should be established bucal to the implant. Therefore, placement of the implant too far facially must be avoided. Based on the current data, shifting the implant position slightly more palatal appears to be ideal solution. This makes it possible to establish an adequate distance from the intact buccal plate in immediate implant placement and makes it easier to regenerate adequate bone plate thickness buccal to the implant in delayed implant placement. Palatally, there is about 2mm insertion tolerance. Violation of this tolerance range could result in palatally overcontoured restorations that can narrow the tongue space, impair phonetics, and make it difficult to establish an adequate emergence profile. The further palatal the implant is placed within the 2mm tolerance range, the deeper the implant must be inserted in the apicocoronal dimension to achive an acceptable emergence profile. Because of the anatomy of the alveolar ridge, it is advisable to place the implant axis at a slight buccal tilt relative to the tooth axis. Prosthetic compensation for the tilt should be easy to accomplish if the implant shoulder is correctly positioned. Implant position should be at a distance of 1,5mm from the adjacent teeth mesially and distally This is the minimal distance although there are some articles that even showed that 2mm would be an improvement. If this minimum distance is lacking it will be necessary either to enlarge the space orthodontically or to employ method of narrow implant placement. Apico-coronally Today it is generally accepted that the final implant shoulder sink depth can be determined primarily by the location of the cement enamel junction of the nigboring teeth and by the level of free gingival margin

at the vestibular aspect of these same teeth. Distance should be 3-4 mm distance from the gingival margin of the future restoration. In immediate implants the reference is the gingival distance of the removed teeth. If there is no teeth previously, a wax- up should create a reference of the future restoration. The buccal part of the implant should be 1-2 mm palatal to the emergence profile of the adjacent teeth. A maxillary front tooth extraction leads to approximately 2mm loss in vertical tissue height. Choosing the right implant proved that the stability between the implant and the abutment is crucial to avoid the micromovements which leads to bone resorption. Presence of papilla between an implant and a teeth depends mainly on the presence of inter proximal bone of the adjacent teeth [5]. If there is a bone defect there will not be papilla. There is also a relation between the presence of the papilla and the distance between the contact point and the bone crest where there will be a probability of complete presence if this distance is 5mm or less (98%) [6]. Placing two implants adjacent is always a big challenge. The mean papillary height between to implants will be 3,4 mm, which is in the most of the cases insufficient to achieve an optimal esthetic result [7]. This issue can be solved by placing one implant to substitute two anterior teeth. This way it is expected to achieve a higher papilla level between an implant and a pontic (5,5mm). Several methods have been described to avoid the negative effect of an extraction like immediate implants, barrier membranes although the most suitable technique advocated to preserve the volume of the socket is the ridge preservation [8]. Lately a new technique is being described as an option to perform an immediate implant without the negative consequences of the bone remodeling after an extraction, and the rationale behind this technique is preserving a tooth fragment that will avoid the resorption that takes place after the extraction [9]. Although this technique is quiet promising we should be aware of the incoming publications about a larger follow up of this technique and the predictability of leaving a fragment inside the socket after an extraction. After iplant placement soft tissue alterations can be present and bone resorption, especially horizontally, can reach almost 50%, a situation that bone preservation techniques during extraction can only partially prevent. Vertical bone deficiencies often lead to compromised esthetic outcomes. To address this problem, a variety of different hard and soft tissue grafting techniques have been suggested for both horizontal and vertical bone deficiencies. These techniques are difficult to perform and have a moderate risk of complications. Vertical and horizontal bone loss around implants often lead to compromised esthetic outcomes. To address this problem, a variety of different factors must be considered. These factors can lead to clinical success or clinical failure.

The cementation of fixed implant-supported dental restorations involves the risk of leaving excess cement in the mouth which can promote biofilm formation in the peri-implant sulcus. As a result, an inflammation may develop [10]. Dentists should be made aware of the differences between implants and teeth. Because their peri-implant biology is not the same, the appropriate cementation techniques, suitable cement selections, and even the procedures for the clean-up of excess cement are different. One of this technique eliminate excess cement from the implant restoration by using a 2-step cementation process. A custom acrylic resin abutment, a duplicate of the titanium abutment, is fabricated before the restoration is cemented. At cementation, cement is placed inside the restoration, which is placed onto the acrylic resin abutment outside the mouth. The majority of the excess cement from inside the restoration is expressed onto the acrylic resin abutment. The restoration is then placed on the titanium abutment inside the mouth. The result is a minimum amount of excess cement expressed intraorally. This technique minimizes the adverse biological consequences of leaving excess cement beneath implant-supported restorations [11].



Fig. 1. Removing the excess cement

#### Conclusion

As marginal bone loss primarily depends on numerous background factors, control of this factors may likewise lead to very good clinical results where periimplantitis would represent a very rare disease [12].

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#### **RAPID PALATAL EXPANSION – CLINICAL EVALUATION**

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#### Abstract:

Rapid palatal expansion, a therapeutic method dating from the 18th century, is based on transverse maxillary arch development, resulting in skeletal effects as well as in dental effects, thus opening the median palatal suture. Alongside the transversal changes, sagital, vertical changes with complete nasopharyngeal makeover has been confirmed by the means of cephalometrics and tomographic xray measurements. Rapid palatal expansion, RPE, also known as Rapid maxillary expansion, RME, is widely accepted technique, still there are no unified therapeutic modalities. Main indication for this type of treatment is undeveloped and narrow apical maxillary base, with deep palate, posterior cross bite and breathing abnormalities. Even though there are points of view that this type of treatment should begin at completed permanent dentition to provide more skeletal than dental effects, late mixed and early permanent dentition is usually the best time for begining this type of treatement. Orthodontic appliances for rapid maxillary arch expansion are constantly changing. Today there are many variations of modified appliances, however the basic one is still Hyrax fixed appliance with metal bands on first bicuspids and first permanent molars connected by metal construction with an expanding screw, which is turned for two times a day for forty-five to ninety degrees in another ten to fourteen days. Clinical experiences suggest hypercorrection of maxillary arch until it surpasses the mandibular arch width, and then the period of retention onsets for another three to six months, for consolidation of palatal bone. It is necessary to reduce the dental side effects and to prevent the relapse through the retention period.

## THE DARK SIDE OF ORTHODONTIC TREATMENT: WHITE SPOTS LESIONS

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#### Abstract:

White spot lesion (WSL) is an initial carious lesion that results from the presence of plaque and its metabolic activity. It is an optical phenomenon that is caused by different refraction of light between hydroxyapatite crystals, water and air. The placement of a fixed orthodontic appliance increases the number of retention places. Reduces the possibility of self-cleaning of vestibular surfaces and also makes it difficult to carry out oral hygiene, which can contribute to the development of WSL that represent the unwanted effects of fixed orthodontic treatment, both from the aspect of oral health and the aspect of facial aesthetics. It is particularly important to emphasize that, besides the increase in the incidence of WSL in patients with the fixed orthodontic appliance, white spots thus formed show resistance to remineralization processes. The primary goal of orthodontic treatment is to achieve maximum results from the functional and aesthetic aspect of occlusion. WSL based on their localization endanger the aesthetic component of orthodontic treatment and as such are the subject of many types of research.

### NEW TRENDS IN DENTAL ANOMALIES: PAEDODONTIC AND ORTHODONTIC SOLUTIONS

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#### Abstract:

Dental anomalies that we can see in today's children and adolescents have a series of characteristics, specific to their generation, which require a new therapeutic approach. Structural anomalies, starting from hard dental tissue dystrophy which make the clinical picture of Early Childhood Caries (ECC) so impressive, the Molar Incisor Hypomineralization Syndrome (MIH), exogenous or endogenous White Spot Lesions (WSL), as well as the various types of Amelogenesis or DentinogenesisImperfecta require an updated paedodontic therapeutic approach.Number and shape anomalies, false edentations, the frequent dental inclusions, supernumerary teeth, and dental reinclusions require an interdisciplinary orthodontic approach, which corroborates all specialties within the dental field. In this conference, I will display a dynamic reviewincluding the majority of dental anomalies, based on clinical cases, with a presentation of all the new therapeutic trends in terms of diagnostic evaluation and dental materials, emphasizing some new therapeutic concepts.

#### **ESTHETICS TRENDS IN PEDIATRIC DENTISTRY**

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Abstract: In pediatric dentistry, number of conditions can lead to aesthetically unacceptable situations, like dental caries, early childhood caries, trauma, abnormalities of shape, size and color of the teeth, especially in the frontal region. Esthetic problems at an early age could have a huge impact on the psychological development and social interaction with other children. Today, we have a large number of solutions available for aesthetic problems in pediatric dentistry. Different materials like composites, GIC, raisin modified GIC, fiber-reinforced composites could be used for the treatment in primary and permanent dentition. For full coronal restorations, we can use strip crowns, composite crowns, pedo-jacket crowns, Edelweiss crowns, Nu smile zirconia crowns. Treatment of traumatized tooth, often requires the use of fibre post, veneering, composite or zirconia crowns. Each of the material and technique, which could be used for esthetic restoration in pediatric dentistry, carries its own advantages and disadvantages. The selection of particular procedure depends on number of factors like clinician's preferences, patients requirements and accessibility of products.

Key words: pediatric dentistry, esthetics, dental materials, coronal restorations, composite crowns

#### Introduction

Aesthetics is a branch of philosophy dealing with beauty and the beautiful. Therefore we can say that pediatric esthetic dentistry is a branch that deals with the maintenance and enhance of the beauty of the mouth children through adolescence, including those with special health care needs. Aesthetic restorations can be intra-coronal and extra-coronal. Intra-coronal restorations for primary teeth include Class III and Class V preparations. The best suitable materials for such restorations are composites and glass ionomer cements.

#### **Composite resins**

Composite resins have been utilised to restore mild to moderate inter-proximal carious lesions in anterior primary teeth. Due to pulp morphology, dentine and enamel of primary incisors have less retention for restorative materials compared to permanent teeth. The depth of cavity preparation becomes very shallow, which may result in insufficient amount of restorative material. Composite resin exhibits minimal toxicity, and the true cause of pulp damage is micro-leakage[1].

#### **Resin-modified GICs**

Resin modified GICs are also effective restorative materials for Class III restorations. In circumstances where isolation of the tooth to be restored is difficult, particularly with very young children, this is the restorative material of choice. A success rate of 100% has been reported where the resin-modified GIC was placed and maintained in Class III restorations intra-orally for 4.5 years [2].

#### **Class V preparations**

Resin-based composite is ideal for Class V restorations. It maintains color, provides aesthetics and can be bonded to the tooth structure. Adequate isolation is a basic requirement for such a restoration. Due to the young age of some children and associated behavioural management

difficulty, it is almost impossible to isolate teeth properly for placement of composite restorations. In these cases glass ionomer cement will be indicated. Croll et al. [1] reported a success rate of 98% with Class V resin modified glass ionomer cement placed in primary teeth with an average duration of 4.5 years [2].

#### **Full coronal restorations**

Stainless steel- crowns are considered to be the most durable and reliable means for restoring severely fractured or carious primary anterior teeth. Stainless steel crowns are described as easy to place, fracture proof, wear resistant and attach firmly to the tooth until exfoliation. The main disadvantage is unsightly metallic appearance. As the population is more conscious of aesthetics, these crowns have become less desirable.

Polycarbonate crowns- are heat molded acrylic resins used to restore anterior primary teeth. They are contraindicated in cases of severe bruxism, deep bite and excessive abrasion. They do not resist strong abrasion forces. Advantages include less time form placement, easy to manipulate and can be easily adjusted with pliers.

Strip crowns- have superior aesthetics compared to the other available methods, but they are very technique-sensitive and require a correct patient selection and proper moisture and hemorrhage control. Composite crown relies on enamel and dentin adhesion for retention. Therefore if a lot of tooth structure is absent the longevity of the crown is compromised. Additional retention can be achieved by using mini pins pulpectomised anterior teeth for the retention of strip crowns. Advantages of strip crowns are: they are simple to fit and trim, removal is fast and easy, they matches natural dentition, leaves smooth shiny surface, have easy shade control with composite, are superior esthetically, functionally and economically, crystal clear, thin and are easy to repair [3,4,5,6].

Zyrzonia crowns- esthetic treatment of severely decayed primary teeth is one of the greatest challenges for pediatric dentists. The use of esthetic restoration has become an important aspect of pediatric dentistry. Over the years, numerous techniques for restoring primary teeth have been attempted. Prefabricated zirconia crown (EZ-Pedo, NuSmile Primary Crowns) is an exceptionally strong ceramic crown and offers more esthetic and biocompatible full coverage for primary incisors and molars. They are anatomically contoured, metal free, completely bio-inert, and resistant to decay. Translucency of Zr ceramic provides excellent esthetics and prevents the problem of dark tooth show through endodonticaly treated teeth. It is also provided with Nusmile try-in crown to check fitting prior to final cementation. This feature saves clinician's chair side time [7,8,9,10,11,12].

#### **Fragment reattachment**

Traumatic injuries most commonly affect maxillary incisors (80% central incisors and 16% lateral incisors) due to their anterior position and protrusion caused by the eruptive process. Reattachment of a tooth fragment (Fig. 1) should be preferable for restoring fractured teeth. There are several advantages in this treatment such as obtaining aesthetic in a single appointment, being a more conservative procedure, obtaining healthy periodontal attachment and maintenance of the original tooth contours and translucence. The reattachment technique was first described in 1964 by Chosak and Eidelaman. At that time, it was considered as a provisional restoration due to the low bond strength values achieved by the adhesive systems. However, the remarkable advancement of the adhesive systems and resin composites has made the reattachment of tooth fragments a procedure that is no longer a provisional restoration, but rather a treatment offering favourable prognosis. This procedure found a strong argument in a conservative philosophy, since it does not require excessive wear of the healthy tooth structure and do not make unfeasible any other later possible restorative treatment [1,2].



Fig. 1. Fragment reattachment

#### Prosthodontic replacement of teeth

Teeth can be lost due to various reasons like: caries, trauma, infection, congenital anomalies, systemic disorders, premature tooth loss, radiation damage, intrinsic stains, neoplasia. Replacement of missing teeth is essential to establish aesthetics, speech, mastication, integrity of dental arches, health of supporting tissues, prevention of bad habits and for the psychological and mental health of patients. Prosthetic appliances may be either removable or fixed. When constructing either type, it is best to allow 6-8 weeks of resting period for good healing and gingival retraction. In children or adolescents with anterior tooth loss, space closure with the patient's own teeth should be considered as the first choice to avoid lifelong restorative needs. Thorough diagnostics and treatment planning are required when autotransplantation or orthodontic space closure is considered. If these options are not indicated and a single tooth implant restoration is considered, implant placement should be postponed until adulthood, particularly in young women and in patients with hyperdivergent skeletal growth pattern. A ceramic resin-bonded fixed dental prosthesis with 1 retainer is an excellent treatment solution for the interim period; it may also serve as a long-term restoration, providing that sound enamel structure is present, sufficient framework dimensions have been provided, adhesive cementation techniques have been meticulously applied, and functional contacts are avoided [1,13,14].



Fig. 2. Adhesive bridge of tooth 12

#### Conclusion

In restorative dentistry, choosing the correct restorative material is one of the primary variables that determine its success. Many new developments have occurred in restorative dentistry

for children in recent years. Along with the development of newer restorative material the pediatric dentist has a wide array of esthetic restorations and crowns available for restoring primary and permanent anterior teeth. Thus, esthetics has become a respectable and mandatory concept in dentistry today. The present era of dentistry relies extensively on aesthetic principles because of increasing patient demands. A restorative dentist should try to meet these demands, while simultaneously considering the patient's socioeconomic status.

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### THE USE OF INJECTABLE BIPHASIC CALCIUM PHOSPHATE IN GUIDED BONE REGENERATION

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Abstract: One of the most frequently used techniques in implant dentistry, with a predictable clinical outcome, is the Guided Bone Regeneration (GBR). The use of alloplastic materials in GBR has numerous benefits: avoidance of the secondary surgical site, potential infectious disease transmission and the unlimited supply of the material. Biphasic calcium phosphate is a mixture of hydroxyapatite (HA) and  $\beta$ -tricalcium phosphate ( $\beta$ -TCP). The primary objective of this paper is to present GBR surgical technique and biomaterials used in GBR, while the secondary is to give an insight in the study plan and preliminary clinical results on the use of the injectable biphasic calcium phosphate in GBR.

Key words: guided bone regeneration, biphasic calcium phosphate, implant dentistry

#### Introduction

Guided bone regeneration (GBR) is the method used to promote bone regeneration in the situations when there is no sufficient height and width of the residual alveolar ridge to place a dental implant. The term "guided bone regeneration" was used for the first time by Bauser et al. (1). A crucial part of the GBR procedure is to ensure the isolation of the bone defect against gingival connective tissue and epithelium by surgical placement of physical barriers (1-3). Bone grafting materials are used to preserve volume stability under the membrane. Seibert and Nyman (2) first described the use of alloplastic bone graft in combination with membranes. Today, the focus has shifted to minimally invasive surgical procedures and reduced post-surgical recovery time, furthermore, there is a continuous development of materials used in GBR. Different bone graft materials such as autogenous bone, allografts, xenografts, and alloplastic bone grafts, in combination with membranes, are used to promote bone regeneration (4).

Autogenous bone considers to be a gold standard, but the usage of autogenous bone enhances risks for potential complications such as infections or nerve damage at the donor site, furthermore, there is a problem regarding the limited availability of the autogenous bone (5). It is known that in indications such as socket preservation or regeneration of smaller intrabony defects, bone graft materials have equal performance (6).

The use of alloplastic materials in GBR showed to be a good alternative to a gold standard. Alloplastic bone substitutes are based on hydroxyapatite (HA), alfa-tricalcium phosphate ( $\alpha$ -TCP) or beta-tricalcium phosphate ( $\beta$ -TCP) and their combinations.

Biphasic calcium phosphate is a mixture of hydroxyapatite (HA) and  $\beta$ -tricalcium phosphate ( $\beta$ -TCP), of varying HA/ $\beta$ -TCP ratios, most commonly 60:40 and 70:30. During the bone healing,  $\beta$ -TCP resorbes rapidly, and the volume stability of the transplant during new bone formation process maintains because of a high HA content (7). They are commercially available as granules which need to be mixed with a solution prior application in a bone defect, and as an injectable paste. Alloplastic bone substitutes in the injectable form are useful for bone augmentation in three-dimensional cavities. Their viscosity allows easy filling of the bone defect, which also reduces surgery time and the burden to the patient (8). Previous in vivo studies showed that injectable bone substitutes based on  $\beta$ -TCP have osteoconductive properties (9,10). Papanchev et al. (11) reported one clinical case on use of biphasic calcium phosphate paste in sinus-lift procedure. However, currently,

there are no clinical studies on the use of injectable biphasic calcium phosphate (I-BCP) consisting of 60% HA and 40%  $\beta$ -TCP in GBR. In present study we want to asses clinical, histological and radiological poperties of I-BCP, containing 60% HA and 40%  $\beta$ -TCP.

#### **Study protocol**

The study is designed as a prospective single-arm clinical trial and consists of two stages. At the first stage of study twenty patients with an indication for GBR after the tooth extraction and prior to the dental implant placement will be enrolled in the study. The indications for tooth extraction included chronic periodontal disease, failure of the endodontic treatment, and vertical fracture of the root. Selection of patients is done in dental practice specialized in oral surgery in Community Healthcare Center in Osijek. All surgeries will be done by one experienced oral surgeon. Patients must meet all the following criteria to be eligible to enter the study:

- adults aged 18 to 60 years;
- physically and mentally healthy;
- at least one or two-walls defect after the tooth extraction;
- patients able and willing to comply with the research protocol;
- written informed consent.

The patient may not enter the research if they meet any of the following exclusion criteria:

- absolute medical contraindications to dental implant therapy according to Hwang and Wang (12);
- radiation therapy or treatment with bisphosphonates;
- smokers (>10 cigarettes/day);
- alcohol abuse;
- pregnancy;
- lack of motivation and poor oral hygiene habits;
- unwilling to sign informed consent.

Antibiotic prophylaxis is administrated one hour prior to the surgery (500 mg amoxicillin or 600mg clindamycin, if there is potential for an allergic reaction to penicillin). After administration of local anesthesia (lidocaine 2%), patient rinses oral cavity with 3% chlorhexidine solution for one minute. The site of extraction is exposed via elevation of a mucoperiosteal flap. Atraumatic extraction is performed and followed by curettage of the socket. Following the debridement, a socket is filled with I-BCP consisting of 60% HA and 40%  $\beta$ -TCP (Figure 1.). A resorbable native collagen membrane is trimmed and adapted to cover the bone defect fully (Figure 2.). The mucoperiosteal flap is readapted, and the wound is closed with single sutures. Seven days following the GBR all patients will receive a cone beam computed tomography (CBCT) to check if there is any dislocation of the bone graft. The sutures are removed after 10 days.



Fig. 1. Filling of the defect using I-BCP



Fig. 2. Covering the defect with native collagen membrane

Six months after the GBR, the second stage of the study will start. CBCT will be taken to assess bone volume after six months of healing, and to plan dental implant restauration. In this stage, a reentry procedure will be performed to harvest bone for histological analysis, and to place a dental implant. A trephine bur with an internal diameter of 2.5 mm will be used to harvest the bone from the central part of the pre-existing bone defect. The primary objective of this study is to clinically assess the handling of the I-BCP during the surgery and the presence of complications during the healing, while the secondary objective is to histologically assess the osteoconductive potential of I-BCP in GBR.

#### **Preliminary results**

Biphasic calcium phosphate in injectable form so far showed easy handling and filling of the intrabony defects. So far, all wound healings were uneventful. Also, CBCT scans show no dislocation of the bone graft seven days post-implantation. The preliminary histological finding of the biopsy specimen showed bony integration of the biphasic calcium phosphate granules into newly formed bone within the peripheral regions of the implant preparation sites. The granules were fully integrated into bone tissue, and there are no histological signs of inflammatory tissue response.

#### Conclusion

This paper gives an overview of the GBR and materials used in that technique, along with the study plan of using the alloplastic material - I-BCP in GBR. In the present study, the regenerated bone was evaluated by descriptive histological examination. Biphasic calcium phosphate paste, consisting of 60% HA and 40%  $\beta$ -TCP, showed osteoconductive potential for bone regeneration. Further work is needed to complete histological, radiological and clinical evidence of osteoconductive properties of I-BCP.

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## NONDESTRUCTIV METHODS FOR IMAGISTIC ASSESSMENT OF SINTERING TEMPERATURE IN DENTAL CERAMIC TECHNOLOGIES

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#### Abstract:

**Introduction**: Acceptable restorations require the alloy and ceramic to be chemically, thermally, mechanically, and aesthetically compatible. Thermal and mechanical compatibility include a fusing temperature of ceramic that does not cause distortion of the metal substructure. A major problem in the ceramic dental technologies is the fracture initiation and the failure of the restoration due to the thermal stress induced by the decalibration of ovens used for sintering of the ceramic layers for metal ceramic dental prostheses.

The **aim** of this study is to approach this issue by using an established biomedical imaging technique, optical coherence tomography (OCT). This technique, based on the principles of low coherence interferometry, presents millimeter depth penetration and micrometer resolution. We tried to observe a pattern inside the sintered ceramic materials for higher or lower real temperature inside the oven using optical coherence tomography (OCT).

**Materials and methods.** 50 samples of metal ceramic crowns were obtained. The samples were divided in 5 groups: first - the reference group (where the temperature is the same with the one recommended by the producers). The next two groups were done by increasing the temperature (with 30 and with 50 degree over the recommended one). The last two groups were made by decreasing the sintering temperature with 30 and 50 degree under the recommended one. Then swept source (SS) OCT was employed to evaluate the pattern from the sintered ceramic under 1 mm under the surface for each group.

**Results and discussions.** Specific pattern was observe for the groups with sintered ceramic over the recommended temperature when OCT was used. A different pattern was identified for the groups where the ceramic was sintered under the recommended temperature. Both described patterns differs in compare with the one in normal sintered ceramic group (the reference group).

**Conclusions.** This study demonstrates the capability of optical coherence tomography (OCT) to achieve a simple and non-invasive monitoring of the temperature variation inside a ceramic oven, to avoid producing dental prostheses with defects.

**Keywords:** thermal stress, metal ceramic dental prostheses, sintering temperature, swept source optical coherence tomography, noninvasive evaluation

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#### **NEWS IN DENTAL IMPRESSION TECHNOLOGY**

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#### Abstract:

**Introduction**: The classical methods for dental impression usually involve errors which will be reflected in the accuracy of the future prosthetic construct. One possible solution for the old fashion methods is to use the optoelectronic impression. Some limitations are pointed out also for this technology. The **aim** of this presentation is to present new types of impressions, for classical and for the optoelectronic methods, as an improvement in compares with the others solutions.

**Materials and methods.** Based on the classical impression technique of dental structures, 3D printing technology was used in order to obtain a particular structure that will lead to a more stable impression. Optical coherence tomography (OCT) was also employed for the optoelectronic alternative. The system used was a Spectral Domain OCT which was working at 860 nm. An incisor abutment was used for this evaluation. 5 classical impression using dental impression material was used and then the models were poured in a conventional mode using gips. For the optical impression, the Planscan scanner (Planmeca) was used. The 3D digital model was obtained both by CAD CAM and Printing 3D technology. The same abutment was used for optical coherence tomography working in Spectral Domain. The 3D digital model was milled and printed using the same mentioned technologies.

**Results and discussions.** Both methods shows improvements in compare with the clasical and digital solutions in terms of stability (for the clasical one) and speed along with the noncontact and minim invasive approach (for the OCT solution). Finally, all the 3D models obtained were evaluated by optical coherence tomography working in Time Domain Mode in order to have a volumetric evaluation.

**Conclusions.** The conclusions pointed out the fact that optical coherence tomography could be employed for the dental impression technology in a non-retraction cord manner.

**Keywords:** impression methods, classical impression technology, swept source optical coherence tomography, noninvasive evaluation

### SAME-DAY RESTORATIONS WITH CAD/CAM TECHNOLOGY

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**Abstract:** The development of computerized systems for the production of dental restorations and the emergence of new ceramic materials have led to important changes in clinical protocol for dentists and dental technicians and also creates new treatment options that may be proposed to patients.

The concept of chair-side CAD/CAM dentistry used to be marketed as scanning, designing, and milling of restorations all in one visit, that basically eliminates the dental laboratory contribution. Over the past several years, the materials for chair-side milling became more versatile. The following criteria must be observed when choosing the CAD / CAM block: tooth color, restoration type, restoration thickness, processing technique and cementing material.

Key words: CAD/CAM, dentistry, chair side, restorations, thickness

#### **Purpose:**

The purpose of this paper is to present the protocol of the chair-side CAD/CAM technology for different clinical situations and compare the accuracy of intraoral scanning between different operators, when different clinical factors are simulated in vitro.

#### Introduction:

CAD/CAM dentistry has evolved tremendous since the first CEREC was introduced, and the changes in the more recent years that have influenced the way we practice our profession.

Since the fabrication of the first prosthetic restoration based on a digital intraoral impression, which was produced in 1985, there has been a tremendous development in this field, especially over the last few years.[1]

Direct intraoral optical impressionscan avoid some errors that can appear during conventional impression techniques. Additionally, intraoral scanning can save time compare to conventional impression and also lowers the cost of materials.[2].

Nowadays, the main goal of an intraoral scanning system is to get as much precision as possible, especially for larger scanning areas and also to simplify the clinical manipulation [1, 2.)

Intraoral scanners require a direct line-of-sight on to any area that should be recorded, and there are several factors that can affect the quality of image acquisition.[3].

Despite the positive aspects of digital intraoral impression procedures, one fundamental clinical problem remains: all scanners are optical systems that only can record visible areas. Thus, blood and especially saliva, combined with subgingival finish line, substantially complicate the scanning process.

#### Material and methods

A superior first premolar on a typodont cast (Frasaco, Germany) was prepared for an all-ceramic crown with equigingival (buccal) margins and 1mm supragingival (lingual) margins.

The master cast scan was obtained by scanning with a model scanner (D7000, 3 shape). An intraoral scanner (Planscan, Planmeca) was used to acquire sets of four scans, each under varying conditions: 1) the presence/absence of adjacent teeth; 2) with and without margins elevation; 3) with the model hand-held or mounted in manikin head. Every combination was investigated.

Scanning was done in three different scenarios by each operator. The first scenario captures the prepared tooth with oneadjacent tooth. All three operators: a student, a, prosthodontics resident and a prosthodontics specialist performed the intraoral scanning.(Figure 1).



Fig.1 Prepared abutment with one adjacent tooth

The second scenario is the one in which the prepared tooth has two adjacent teeth and was scanned by all three operators (Figure 2).



Fig.2 Prepared abutment with two adjacent tooth

The last scenario, is the one in which the three operators scanned the prepared tooth in the absence of the both adjacent teeth (Figure 3).



Fig.3 Prepared abutment without two adjacent tooth

The .STL files resulting from the intraoral scanning were compared with those obtained with a laboratory scanner, using a software analysis. The .STLfiles obtained by the laboratory scanner (Fig.4) were considered as master files. The master scan was aligned to each intraoral scan, from all three scenarios.

All data and computations were performed using metrology software, Geomagic Qualify. Overlapping the STL files allowed the measurement of deviation patterns from the reference models.

#### **Results**:

Compare to equigingival (buccal) margin, the supragingival (lingual) margin contour remained consistent regardless of scanning conditions. Mesial margin shape was significantly influenced in the presence of adjacent teeth and proximity to the gingivae and position of the wand. Distal and mesial margin shape was significantly influenced in the presence of adjacent teeth and all margins were influenced by the proximity to the gingivae.(Table 1).

Table 1.							
	0 adiacent	1 adiacent	2 adiacent				
	teetn	teetn	teetn				
op1	0,028	0,03	0,061				
op2	0,0101	0,0507	0,0006				
op3	0,0349	0,0371	0,0145				
average	0,024333333	0,039266667	0,025366667				

#### Discussion

This study revealed the role of confounding clinical factors, that can influence the scanning accuracy. The most important factor is the presence/absence of the adjacent teeth and the position of the marginal finish line.

A number of *in vitro* studies showed that intraoral scanners can reliably record the margins of a preparation, and can generate acceptable crowns.[3,4,5]. However, most of them do not take into consideration all the factors that influence the accuracy of digital impressions, and as a result have limited relevance in clinical practice.

#### Conclusions

Within the limitations of this study, it can be concluded that the accuracy of the margin recorded by an intraoral scanner is significantly influenced by clinical factors and an intraoral scanning require a direct line-of-sight when scanning crown margins. Successful and long-lasting CAD/CAM chair-side restorations require correct indication and precision in every clinical step.

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### SOCKET PRESERVATION AND IMMEDIATE PROVISIONALIZATION USING THE EXTRACTED TOOTH

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#### Abstract:

Socket preservation is a hot topic this days. In most of the cases we prefer to do nothing and leave the post-extractional socket to heal by itself. If we get lucky we end up, after six month with a 2-3 mm vertical loss and a 4-6 mm horizontal bone loss. This is the case of a socket type 1. In socket defects type 2 and 3 the tragic results becomes more obvious.

If we are planing to put an implant, immediate or delayed, the patient is more willing to pay for socket preservation. In most cases we take a jar, open it and put the contents inside the wound. In an ideal situation we cover it with a membrane.

The extracted tooth is considered infected material and thrown in the garbage.

The author is sharing different protocols of reusing the extracted teeth for different indications. A special focus is put on the first maxillary molar, a region extremely difficult in terms of immediate implant placement, bone generation and immediate provisionalization, targeting a final restoration after 5 months.

The message of the author is very simple: Please consider to preserve the bone after extraction, maybe with the best material you can get on the market - the patients own teeth.

## MORPHOLOGICAL AND AESTHETIC ASPECTS OF RESTORATION OF FRONTAL TEETH

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#### Abstract:

The problem of aesthetics has always attracted the attention of a dentist. This problem is still relevant to such an extent that the aesthetic component often represents the decisive moment that consents the patient to undergo dental prosthesis therapy, or vice versa, that the patient refuses to wear a prosthesis if he considers that she does not respond according to her aesthetic qualities to his requirements .

From the history of dental prosthetics in general, it is known that the first prostheses were preaesthetic or religious-mystical, rather than functional, in order to beautify the face of the wearer or, if the prosthesis served the tribal doctors and their religious rituals to make them face a scary.

Adhesive technologies and high-strength ceramic materials of high strength form the basis of modern reconstructive dentistry and are increasingly accepted as the primary solution.

The key reasons why non-metallic restaurations are increasingly used in clinical practice are: aesthetic, because they offer a natural and functional result; simplify clinical procedures and enable biological protection of dental tissues, vitality of the pulp and health of the periodontal complex.

### BIOMATERIALS FOR BONE AUGMENTATION IN IMPLANT DENTISTRY

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**Abstract:** A successful implant-supported prosthetics rehabilitation is possible only with a sufficient height of residual alveolar crest. Augmentation procedures in implant dentistry, performed prior or during dental implant placement, ensure the adequate volume of alveolar bone, which is essential to achieve optimal aesthetics and functional rehabilitation. The objective of this paper is to present the current knowledge about the classification, advantages, and disadvantages of biomaterials used for bone augmentation, taking into consideration their biology.

Keywords: dental implantology, biomaterials, augmentation

#### Introduction

Despite numerous treatment options, failures in dental treatment still lead to tooth loss. Implant-supported restorations are by far the best solutions in case of tooth loss. The physiological process of bone healing usually is not resulted in original alveolar ridge volume, which would be ideal for implant placement. According to the review on alveolar socket healing written by Araújo et. al (1), a socket-healing process can be clinically and radiographically observed. The clinically healing process finalizes by restoration of the socket entrance, which occurs between 10 and 20 weeks, while radiographical changes are completed between 3 and 6 months after the tooth extraction. The greatest changes in width and height of alveolar ridge occur during the first 3-months of healing, but it can continue over the 1-year post-extraction (1.2). Differences in bone biology among individuals, the size of the alveolar defect (large vs. small sockets), the presence of bone dehiscences or fenestrations, along with the extent of trauma during tooth extraction can lead to even more severe bone loss (3). To minimize all the above difficulties prior implant placement it is recommended to do bone augmentation procedures. The purpose of augmentation procedures is to create a scaffold which will support new bone formation. It is known that autologous bone is the "gold standard", but because of certain complications involved with its use (morbidity at the donor site, nerve damage, etc.) and limited availability, there is a continuous development of alternatives. Biomaterials for bone augmentation in implant dentistry can be classified as bone substitute materials (allografts, xenografts, and alloplastic bone substitutes) and membranes for guided bone regeneration (4-6).

#### Allografts

Allogenic bone is harvested from an individual (living donor or cadaver) of the same species, but with a different genotype. Allografts have been used since 1950s, firstly in the United States, but today they are available from bone tissue banks all around the world (7). To obtain good results while using allogenic bone, it is important to think about its biological properties, process of preparation and safety. Taking into consideration that autograft is the gold standard, the benefits of allogenic bone are avoidance of secondary surgical site, along with potential risk for infection at the donor site, reduced surgical time, and an unlimited supply of it. Osteocytes in harvested bone are dead, consequently, the allografts themselves do not contribute cells to osteogenesis. The new bone formation is resulted by the complex activity of the recipient's mesenchymal cells. Mesenchymal cells induce the formation of the osseous bridge at the host-graft interface, and it is resulted in the replacement of the bone graft (7,

8). Concerns about disease transmission from the donor to the recipient have been raised in the 1980s, but today it is known that with careful donor screening and processing of the donor's bone, the risk is very low. Freeze-drying is most frequently sample processing method. Freeze-drying results in two forms of the allografts: demineralized freeze-dried bone allograft (DFDBA), or mineralized freeze-dried bone allograft (FDBA). Because of the mineral content, FDBA undergoes slower resorption than DFDBA. The demineralization process of DFDBA eliminates mineral content of the bone graft, which leads to exposure of the bone collagen and bone growth factors such as bone morphogenetic proteins (BMPs). Therefore, DFDBA may show higher osteoinductivity, but overall it depends on the qualitative and quantitative properties of the bone matrix in the allograft (9).

#### **Xenografts**

Xenografts are bone substitutes taken from a non-human species, in example bovine, pigs and horses. Before the use, bone needs to go through the mechanical and chemical purification process to eliminate organic content, which results in hydroxyapatite granules, very similar to hydroxyapatite in human bone. Xenografts are biocompatible, hydrophile and have osteoconductive properties. Ossification process while using xenograft is a result of the recipient's cells colonization through the xenograft which leads to the formation of the bone matrix. Xenografts are scaffolds for new bone formation and following the bone healing, they stay incorporated into the newly formed bone. A histological study by Jensen et al. (10) has shown that defects filled with anorganic bovine bone regenerated with newly formed bone and particles of the graft material were complete integrated within it. Xenografts of bovine origin, in theory, may carry the potential risk of transmitting the prion infection to the recipient. However, although studies have shown that risk of disease transmission is insignificant, suspicious about that theories still exist (11). Commercially they are available as bone blocks or granules (small or large particle grafts). It is recommended to use small particle grafts in smaller defects, contouring of the alveolar ridge and to fill small peri-implant defects (i.e. dehiscences and fenestrations), while large particle grafts are a better choice while filling large bone defects. Xenogenic bone block may break during the fixation, which compromise surgical procedure and bone healing. Xenografts are used in indications such as socket preservation, sinus floor augmentation, and guided bone regeneration. Also, because of the good mechanical properties and resistance to resorption, they are often used along with autogenous bone to achieve volume stability of the graft (12, 13).

#### Alloplastic bone substitutes

Alloplastic bone substitutes are completely synthetic materials. Alloplastic bone substitutes are based on hydroxyapatite (HA), alfa-tricalcium phosphate ( $\alpha$ -TCP) or beta-tricalcium phosphate ( $\beta$ -TCP) and their combinations. The advantages while using them are the elimination of the risk for disease transmission, unlimited availability and biocompatibility. They are available as granules, bone blocks or as a paste in injectable form. The resorption rate of alloplast depends on chemical properties, porosity of the material and particle size. Large particle grafts need more time to resorbe. The high porosity of the material gives more space for bone regeneration, but consenquently, the material is resorbed faster. Today, the combination of HA and  $\beta$ -TCP (biphasic calcium phosphate) is usually used (such as Maxresorb, BoneCeramic, etc.) (14). Ratios of HA/β-TCP usually are 60:30 or 70:30. In healing process,  $\beta$ -TCP resorbes faster than HA, so HA ensures the volume stability of the grafted area. Biphasic calcium phosphate in injectable form shows promising results regarding to easy handling, easier filling of the three-dimensional defects (such as sinus cavity and extraction sockets) and reducing the surgery time (15). Furthermore, there is a constant work on development of new forms of alloplasts associated with hyaluronic acid, collagen, and other osteoinductive biomolecules such as BMPs and fibroblast growth factor-2 (FGF). These combination resulted in a better features of newly formed bone (16).

#### Resorbable and non-resorbable membranes

Guided bone regeneration is one of the most frequently used methods to promote bone

regeneration. Besides the use of the bone graft materials, an important part of the surgical procedure is the placement of the physical barrier, which needs to isolate the bone defect against the fast migation cells from soft tissue, and allow migration of cells crucial for bone regeneration. In that purpose, we use resorbable and non-resorbable membranes. Resorbable membranes are usually made of synthetic polymers and natural biomaterials (such as native collagen membranes). Non-resorbable membranes are classified as titanium-reinforced or polytetrafluoroethylene (PTFE) membranes (17). Soldatos et al. (18) reported that membrane exposure is the complication which has the strongest impact on the final clinical result for both types of membranes. Moreover, for vertical bone augmentation, using non-resorbable membranes resulted in better outcomes, while for combination defects both types had a good result.

#### Conclusion

Successful bone augmentation and implant-supported prosthetic rehabilitation does not only depend on the clinical skills of the practitioner, but also on the appropriate choice and use of different biomaterials. The study of biomaterials and implant dentistry are one of the fastest-growing disciplines in dentistry. Bone substitutets overcome problems related to the use of the autogenous bone grafts and provide good results regarding to bone regeneration and implant stability. Development of new biomaterials and improvement of the existing one is for sure an area in need of research attention.

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# ANTIMICROBIAL PHOTODYNAMIC THERAPY - MINIMALLY INVASIVE APPROACH IN THERAPY OF PERIODONTAL DISEASE

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Abstract: To date, the mechanical debridement and adjunctive use of antibiotics are considered conventional method of periodontal and peri-implant therapy. Recently antimicrobial photodynamic therapy (aPDT) has been introduced as an improved antimicrobial approach alternative to antibiotics. aPDT is defined as an oxygen-dependent photochemical reaction, where the use of a photosensitizer is combined with low-level light energy to achieve an antimicrobial effect. Reactive oxygen species produced by the photonic absorption in the dye chemical is cytotoxic to the target bacterial cells. The numerous in vitro studies have clearly demonstrated the bactericidal effects of aPDT. aPDT shows low local toxicity, can accelerate dental treatment, has a low cost, several photosensitizers are available for each type of light source and the treatment will not cause any harm to the patient. To date, limited number of clinical studies are published where aPDT is used as an adjunctive to scaling and root planing, wherein demonstrated significant short- and long-term benefits in clinical parameters (such as pocket probing depth or clinical attachment level) in the therapy of chronic periodontitis.. However, in order to give any solid recommendation of aPDT as an efficient minimally invasive alternative to antibiotics either as standalone or adjunct treatment to mechanical debridement in therapy of periodontal and peri-implant disease, further research, especially randomized controlled trials with long-term follow up and a larger number of patients and meta-analysis are necessary.

*Key words:antimicrobial photodynamic therapy, aPDT, periodontal disease, scaling and root planning, antimicrobials in periodontal therapy.* 

# Introduction

Periodontal disease is chronicpolymicrobial disease, which affects 90% of the population worldwide [1].Periopathogens, such as *Porphyromonasgingivalis* (*Pg*), *Tannerella forsythia* (*Tf*), *Treponema denticola* (*Td*) and *Aggregatibacteractinomycetemcomitans* (*Aa*) are strongly associated with periodontal disease [1, 2]. It is suggested that these periopathogens produce several potentially pathogenic substances, including chemotaxis-inhibiting factor, outer-sheath-associated peptidases, leukotoxin, collagenases, chemotrypsin-like proteinases and endotoxin, which allow bacteria to colonize the periodontal pocket and initiate the destruction of tissues [1].

The mainstay in the therapy of periodontal disease is to disorganize bacterial biofilms supra- and subgingivally, and consequently to reduce thenumber of periopathogens. Removal of irritants from the root surface and subsequent break in the subgingival biofilm formation result clinically in reduction in the probing pocket depth and a gain in the clinical attachment level. The reduce in periopathogens can be achieved by standard, the most common mechanical debridement- scaling and root planing (SRP), with the adjunctive use of systemic or local antibiotics (combination of amoxicillin and metronidazole). To date, studies have reported that SRP when performed with adjunct antibiotic therapy is more effective in the treatment of periodontal disease than when SRP is done alone [3]. Despite microbiological improvements, there are recommendations to restrict the use of antibiotics in periodontal therapy in order to limit the development of microbial antibiotic resistance, and more important the development of superinfections that are difficult to eradicate[2, 3]. SRP has some limitations, as well, which attenuates complete elimination of subgingival calculus and bacterial deposits from deep periodontal pockets, interproximal and furcation areas [3].

To overcome the limitations of SRP and to reduce the bacterial load, antimicrobial photodynamic therapy (aPDT) has been proposed as an efficientalternative antimicrobial procedure in therapy of periodontal disease.aPDT was firstly introduced in 1904, as the light-induced inactivation of the cells, molecules and microorganisms [4]. Even though the effects of photodynamic action are known for a long time, it gained attention in dentistry just recently [4]. The action of aPDT involves three main components including different sources of light, a photoactivable substance/photosensitizer (PS), and oxygen. Upon administration of PS dye in the periodontal pocket, excitation is achieved with light of a particular wavelength, either by lasers or light emitting diodes. The PS absorbs the energy directly from the light source and transfers it to the generation of reactive oxygen speciesfrom ground singlet state to a higher-energy triplet state that reacts with endogenous oxygen to produce singlet oxygen and other radical species (type I and II reaction). Finally, it cause a rapid and irreversible damage of the target bacterial cytoplasmic membrane, including protein modification, respiratory chainbreakdown and nucleic acid alterations. The benefits of aPDT includes eradication of periopathogensand risk of bacteremia, least antibiotic resistance without systemic disturbance [2, 4] and, furthermore, without host tissue damage due to the protective presence of keratin which inhibits the cytotoxic activity.

#### Use of aPDT as an adjunctive in therapy of chronic periodontal disease

Clinical studies have demonstrated the effect of aPDT as an adjuvant therapy for the treatment of chronic periodontitis[5-15].

In a clinical trial by Betsy et al. periodontitis patients treated with aPDT, using methylene blue PS activated by 660 nm laser light, as an adjunct to SRP, showed significant reduction in periodontal pocket depth after three months and halitosis only after one month, compared with those treated with SRP alone [5]. Similarly, Alwaeli et al. using phenothiazine chloride PS activated by 660 nm diode laser, demonstrated significant improvement in evaluated clinical parameters (periodontal pocket depth, clinical attachment level, bleeding on probing) for one year follow-up, suggesting that aPDT is a promising therapeutic concept for persistent periodontitis [6]. Campanile et al. used methylene blue PS activated by diode (670 nm) laser light twice a week, suggesting that increasing number of application of PS and laser had a beneficial outcome, represented in clinical parameters as well as C-reactive protein values [7]. Similar results were obtained by Theodoro et al. using toluidine blue PS activated by 660 nm laser light and Braun et al. using phenothiazine PS and 660 nm diode laser light [8, 9]. In a clinical trial by Moreira et al. periodontitis patients treated with aPDT, as an adjunct to SRP showed significant reduction in the counts of all four major periodontal pathogens (*Pg, Tf, Td, and Aa*) compared with those treated with SRP alone at 3-month follow-up [10].

However, in a similar clinical trials several authors failed to demonstrate the superiority of aPDT as an adjunct to SRP when compared to SRP alone [11-15]. They demonstrated that both treatments resulted in significant clinical improvements (either SRP or SRP+aPDT), but no significant difference was observed among these two treatment modalities at any time points for tested clinical parameters and in some studies for expression of inflammatory mediators.

#### Discussion

Studies in adults with chronic periodontitis have shown that the use of an antimicrobial agent as an adjunct to mechanical therapy is more effective in periodontal treatment than isolated SRP therapy. The use of systemic antibiotics in the non-surgical treatment of periodontitis provides a statistically significant reduction of PD after antibiotics use (amoxicillin and metronidazole) compared to isolated SRP. Despite the satisfactory clinical results, antibiotic therapy usually leads to undesirable side effects, mainly development of bacterial resistance. To minimize such effects, the search for local antimicrobial methods for the treatment of periodontitis continues to be widely investigated. The majority of to date published articles describe aPDT as a secure antimicrobial procedure with potential improvements in clinical parameters when used in association with SRP. The additional benefits of aPDT in terms of clinical, microbiological, immunological, and patient-based outcomes are definitely encouraging and, hence, should be included in the routine treatment protocol of patients with periodontitis [5]. However, only two studies so far compared SRP+aPDT and SRP+antibiotics [7,16]. In both studies, use of antibiotics as an adjunct to SRP demonstrated significantly better

outcome as compared to aPDT. But, authors agreed that aPDT has the advantage of possible repeated application without bacterial resistance. But, it is recommended that future studies should be carefully designed and conducted in order to rationalize the use of aPDT in management of periodontal disease and to establish clinical protocolsfor aPDT in chronic periodontitis. However, in order to establish efficient clinical protocols, several important issues should be further analyzed.

Antimicrobial photodynamic therapy has been applied using various combinations of lasers andphotosensitizing (PS) agents. Methylene blue and toluidine blue were the most commonly used PS dyes in the clinical trials. They are the PS agents of choice for aPDT because they have a pronounced cationic charge that helps them bind to the outer membrane of Gram-negative bacteria and penetrate bacterial cells. However, there are no studies demonstrating greater efficiency among different PS. Also, these dyes have been used in various concentrations (1 mg/mL to10 mg/mL) with a residence time of 1 to 5 min in the periodontal pocket. To date, only two studies reported the exact quantity of PS used, which was either 0.2 mL methylene blue or 1 ml [7, 8]. All other studies did not suggest the exact quantity in order to carefully interpreter the results and try to obtain the optimum of PS quantity. Further, the number of aPDT application sessions seems to be directly related to the success of the therapy. When aPDT was used in a single session, it did not verify the clinical improvements inPD and CAL for chronic periodontiits treatment in some articles [11-15], although aPDT was able to reduce theBOP of the sites treated [11]. Nevertheless, the evaluation of multiple applications of aPDT effects on the periodontal treatment of residual pockets showed clinical improvements with a reduction of PD with reduced bleeding [7].

### Conclusion

aPDT is a beneficial therapeutic option in the treatment of periodontal disease. The results of many studies, indicate that aPDT along with SRP has a beneficial outcome in the treatment of periodontitis. Although there was a wide range of heterogeneity in the included studies, they all indicated that aPDT has the potential to be an effective adjunct in the treatment of chronic periodontitis. However, in order to give any solid recommendation of aPDT as an efficient minimally invasive alternative to antibiotics either as standalone or adjunct treatment to mechanical debridement in therapy of periodontal and peri-implant disease, further research, especially randomized controlled trials with long-term follow up and a larger number of patients and meta-analysis are necessary.

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# THE ROLE OF PERIODONTAL THERAPY IN THE TREATMENT OF SYSTEMIC DISEASES

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**Abstract:** There has been increasing interest in the association between periodontitis and systemic diseases and conditions. Chronic inflammation and/or microorganisms from destructed periodontium is considered to affect several common, complex systemic diseases. Although the connection of chronic periodontitis with some of diseases is well documented, it is less known whether the periodontal treatment reduces the risk of this illness or affects their management.

This work will present current knowledge of whether successful treatment of periodontitis contributes to the improvement of health and the outcome of systemic diseases.

Keywords: periodontal diseases, treatment, comorbidity; cardiovascular disease; type 2 diabetes;

### Introduction

Periodontitis is one of the most common human diseases [1]. Its prevalence increases with age, and the incidence rises steeply from the age of 40. It is estimated that the number of affected individuals will continue to rise with global population aging and greater percentage of elderly with preserved natural dentition [2]. The early stages of periodontal disease are often symptomless, and a significant number of affected patients are not timely detected. The insidious nature of the periodontitis, as well as relatively low public awareness of periodontal health, leads to many patients fail to seek treatment before the disease has already advanced. Tissue destruction during periodontitis is usually irreversible, and the disease manifestations acumulate with increasing age. As a result, it has been mistakenly assumed that periodontal disease is an inevitable consequence of aging. While these outdated perception have been dispelled by scientific evidence, this view is still common among not only patients, but also some medical practitioners. Periodontitis is an inflammatory disorder which results from interaction between microorganisms of dental plaque and the individual inflammatoryimmunological host response to the pathogens [3]. This is a highly preventable disease that can be easily diagnosed and successfully controlled through adequate professional care and long-term secondary prevention. Suitable preventive measures, along with timely diagnosis and appropriate therapy, could slow down the disease progression, and contribute to improvements in both oral and systemic health.

An extensive body of literature published in recent decades indicates that the importance of periodontal health extends beyond oral cavity. It is widely accepted that, via hematogenic dissemination of bacteria (and their byproducts) from dental plaque and/or inflammatory mediators found in the affected tissues, periodontal disease influences progression of complex systemic disorders, such as atherosclerosis (and its outcomes), diabetes mellitus, respiratory diseases, and rheumaoid arthritis, among others. Even though the relationship between periodontitis and some of these conditions has been well documented, the effects of periodontal therapy on the incidence and progression of these medical comorbidities remains unclear.

In this work, the current knowledge in this filed will be presented, aiming to establish whether successful periodontal therapy can contribute to the advancement of overall health and better management of systemic diseases.

### Periodontal disease and cardiovascular diseases

Atherosclerosis is the main cause of most cardiovascular diseases (CVDs). It manifests through the formation of atheromas on the walls of large and medium-sized arteries, and is responsible for the

ischemic heart disease, stroke, and peripheral arterial ischemia. Historically, atheroma formation has been ascribed to simple lipid accumulation on the arterial walls; however, more recent evidence indicates that endothelial dysfunction and inflammatory processes are the key contributors to this phenomenon [5].

Association between CVDs and periodontitis has been confirmed in an extensive review of literature and meta-analyses [6]. In the recent Swedish 'PAROKRANK' study [7] periodontal disease, was more common in 805 patients with first-time acute myocardial infarction (AMI) than it was in 805 matched controls without AMI. There was also an increased (+49%) risk of AMI among the patients with periodontitis that remained significantly higher (+28%) after adjustment for co-variables (smoking, DM, socioeconomic factors). These findings from the largest and most well-conducted case-control study to date emphasize that there can be an independent association between periodontitis and AMI, which was supported by another recent research [8,9]. Several mechanisms through which periodontal disease could contribute to the development of atherosclerosis and its clinical manifestations have been proposed [10]. The question is whether periodontal treatment can influence this process. Findings yielded by a recent meta-analysis of clinical evidence indicate that periodontal treatment can result in the improvement in many indirect indicators of atherosclerosis. including endothelial dysfunction, lipid parameters, glycated hemoglobin, and biomarkers, such as Creactive protein and interleukin-6 [11]. Longitudinal study conducted in the US has shown that improvement in periodontal status (manifested through pocket depth reduction and reduced periodontal bacteria quantity) resulted in a reduced progression of carotid intima-media thickness over 3 years which was correlated with the degree of periodontal status improvement [12]. The authors of this investigation highlighted the importance of periodontal treatment as a potential preventative health measure. Endothelial dysfunction and coronary arterial wall thickness are indirect indicators of atherosclerosis progression. However, no data pertaining to the effects of periodontal treatment on the clinical cardiovascular outcomes presently exists, given that randomized controlled trials examining this link cannot be conducted for ethical reasons. The longitudinal study based on a random sample of one million people, included 10,887 people, who had received dental treatment and 10,989 age-, sex-, and comorbidity-matched subjects who had not received dental treatment during the average followup period of 7 years, showed a significantly lower incidence of AMI in the scaling group [13]. In addition, multivariate analysis indicated that scaling was independently associated with lower risk of acute heart attack and cerebrovascular insult. As a part of the same investigation, dose-dependent correlation was also established, whereby more frequent plaque removal was accompanied by a progressively greater risk reduction.

# Periodontal disease and diabetes mellitus

Most studies examining the link between periodontal disease and type 2 diabetes mellitus (DM) have focused on the influence of DM on the periodontal disease pathogenesis. Findings yielded by these investigations indicate that patients with DM are at a greater risk for more extensive periodontal destruction, respond less well to periodontal therapy, and have poorer long-term prognosis compared to the healthy controls. American Association for Diabetes has added periodontal disease, alongside micro and macro vascular diseases, on the list of DM complications [14]. More recent evidence points to the bidirectional link between these disorders [15]. Specifically, DM patients have been shown to have greater propensity toward periodontal disease, while periodontal infection and inflammation worsen the course of the diabetes. These findings are supported by a recent systematic literature review [16].

Results yielded by clinical studies indicate that periodontal disease could represent an independent risk factor for the development of DM [17]. Glycated hemoglobin (HbA1c) is a glycemic control indicator and represents an average glycaemia value in the preceding 2–3 moths. In healthy individuals, HbA1c should be below 6%, while HbA1c < 7% indicates good glycemic control. It has been established that DM patients affected by periodontal disease tend to have higher HbA1c values compared to those with healthy periodontium [18]. According to the findings yielded by several meta-analyses, nonsurgical periodontal therapy can reduce HbA1c levels by 0.31-0.65% [11,19,20], which

can have significant clinical implications. A British study involving large patient cohort has established that 1% reduction in HbA1c can reduce the risk of microvascular complications by 35%, whereby the typical HbA1c reduction of 0.2% is linked to 10% lower mortality rate [21]. Consequently, 0.31–0.65% reduction in HbA1c that can be achieved through periodontal therapy can have significant beneficial effect on systemic health. Even though most clinical trials have shown that periodontal therapy yields improvements in glycemic control in patients with type 2 diabetes mellitus, their findings are inconsistent and unreliable due to methodological limitations, such as insufficient control, incomplete information pertaining to the periodontal treatment efficacy, short duration, and small sample size.

### Periodontal disease and rheumatoid arthritis

Rheumatoid arthritis (RA) is an autoimmune disease affecting 0.5–1% of the world population. It manifests through joint inflammation, deformity, swelling, and pain [22]. Like periodontitis, RA is an inflammatory condition that results in tissue degradation, and the link between these diseases has recently been confirmed through an extensive literature review [23]. Available evidence indicates that patients affected by RA have a greater epithelial attachment loss and are four times more likely to develop periodontal disease compared to general population [23]. It is considered that the link between RA and periodontal disease is also bidirectional, and that the latter increases the risk of RA. While research on this topic are limited, the reported findings suggest that nonsurgical periodontal therapy can lessen the clinical RA symptoms, and reduce the level of biomarkers of RA activity [24]. However, it is necessary to note the limitations of these studies, most notably relatively small sample size and short follow-up duration. Thus, large intervention studies involving RA patients affected by periodontal disease are needed in order to reach definitive conclusions on this relationship.

### Periodontal disease and respiratory diseases

In narrative and systematic literature reviews conducted to date, findings yielded by studies linking oral and respiratory diseases were analyzed, providing sufficient evidence in support of this relationship. The effects of oral health status on onset of pneumonia and exacerbation of chronic obstructive pulmonary disease (COPD) remain most extensively studied. Randomized clinical trials indicate that improvement of oral hygiene can prevent development of pneumonia, as well as reduce mortality rates related to this disease, especially among vulnerable patient groups [25]. Studies conducted in the last decade support the hypothesis that bacteria present in the oral cavity can induce pneumonia and contribute to the COPD exacerbation, while dental plaque reduction can reduce the risk of these respiratory diseases [25].

# Conclusion

Extensive research supports the view that periodontal treatment has not only beneficial local effects, but can also contribute to the improvement in general health status and can assist in better management of common systemic diseases, such as cardiovascular disease, diabetes mellitus, and rheumatoid arthritis. Closer collaboration between medical doctors and dentists should increase patent awareness about the periodontal health, as well as the potential and significance of timely periodontal treatment.

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# PREREQUISITES FOR SUCCESSFUL IMPLANT TREATMENT IN THE ESTHETIC ZONE

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#### Abstract:

Contemporary implant dentistry is facing high expectations of patients, not only in terms of function and esthetics of prosthetic restorations but also shorter treatment time.

When placing implants in the esthetic zone, clinicians are often faced with high esthetic demand expressed by patients and anatomically unfavorable conditions including bone and soft tissue deficiencies as a result of ridge alterations following extraction, infection or trauma. Proper case selection, adequate timing of implant placement following tooth removal, bone and soft tissue preservation or reconstruction, correct 3D implant positioning and convenient implant design are key surgical elements for successful results in esthetic implant therapy.

This lecture will show protocols necessary for adequate treatment planning in the esthetic zone, proper determination of time for implant placement and implant loading and surgical protocols for implant placement in the esthetic zone.

# DIGITAL VS. ANALOG IN THE PLANNING AND MAKING OF DENTAL RESTORATION ON IMPLANTS

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**Abstract:** The application of digital technology in dentistry aims at simplifying clinical procedure, greater speed and better predictability, with significant benefit for the dentists and their patient. The integration of digital protocols is a present reality in dental implantology. Almost all stages from planning implant position to final restoration, can be achieved using digital technologies. However, in spite of their significant progress, there are some limitations and difficulties that we encounter during our daily clinical work. In this context, the goal of thispaper is to present a world of contemporary digital technologies, their advantages, possibilities and current limitations. **Key words:** digital planning, CAD-CAM, **implantology**, intraoral scanning

### Introduction:

In the 10 last years, computer technologies are significant development. Application of digital technology in dentistry aims at simplifying clinical procedure, greater speed and better predictability, with significant benefit for the dentists and their patient. The digital technologies became important component in all field of dentistry, including implant dentistry.

In spite of their significant progress, there are some limitations and difficulties that we encounter during our daily clinical work. In this context, the goal of this paper is to present a world of contemporary digital technologies, their advantages, possibilities and current limitations in field of implant dentistry.

Almost all stages from planning implant position, to final restoration, can be achieved using digital technologies. Planning implant position is usually, first step in implantology. Implemantation of cone - beam computed tomography (CBCT), in planning procedure, is significantly improvement precision of implant position.[1,2] Voxel size indicate precision of CBCT. The majority of CBCT's used for dental implant planning has a voxel size of 0.4 mm, and the accuracy of measurements made on the CBCT are directly related to this size. One way to analyze bone density is through the Hounsfield index in procedure of reading CBCT. The Hounsfield scale is based on density values for air, water, and dense bone, which are assigned arbitrarily values of -1,000, 0, and +1,000, respectively. Using these parameters to establish a relative scale, a range of values was providedfor different types of bone, including very dense cortical bone (> 600 HU), dense cortical-spongy bone (between 400 and 600 HU), and cortical-spongy bone of low density (< 200 HU). The Hounsfield scale has been used to evaluate bone densities for implant placement. [3,4,5]Different anatomical structures have varying Hounsfield units. It is important to know how to apply the Hounsfield scale, because the differences in bone densities will alter the chosen surgical protocol for implant placement.

Cone-beam computed technology provide valuable information for evaluation before implant placing and it also translates all informations in completely digital planning of surgical cases and surgical guide. Utilizing a CBCT scan as a template, a surgical guide may be fabricated based on the precise location of a planned implant. All of the major implant companies offer software which can be used for planning the specific location of implants in the CBCT image and eventually guide can be ordered and fabricated. The software allows the virtual placement of implants into the CBCT scan at the precise locationtaking into account considerations such as anatomic landmarks, adjacent dentition, type of restoration and occlusal scheme.

For successful prosthodontics reconstruction precise position of implants is very important. Implant treatment is directed towards functional and esthetic restoration of patients with partial or complete

edentulism. The final prosthetic structure is the starting point in planning treatment, usually is followed the concept of prosthetic guided implantology . [6,7]

Implementation of intra-oral or extra-oral CAD/CAM technologies in dentistry allowed different combination in procedure for making dental restorations, diagnostics and planning tools. One of them is computer created surgical guide, which is planning tools created in special software (3Shape launched a new software module called Implant Studio). (Fig. 1)



Fig.1. Implant position - Implant Studio, 3 Shape

Position of future crowns is important from mechanical and functional perspective of the future implants, respectively their abutments should be located ideally in the center of the future crowns. This is important not only for maximum resistance to bite force, but also for the aesthetic result of CAD/CAM framework for accurate 3D. Planning of dental implant placements and design of surgical guide has been developed by integrating two different imaging modalities:CBCT scanning and surface optical scanning (intra-oral extra-oral). The integration of volumetric radiographic anatomical data (DICOM) with 3D surface information (STL or DICOM) allows accurate reconstruction. Position of implant planning must to be in consideration with anatomical structure, bone density, dimension of alveolar ridge, crown and implants axis, screw hole and abatement design. (Fig 2) Thesurgical guide is directly created in special software, on the final virtual model within the CAD environment. [8] A uniform layer of material is added to the reference surface of the virtual mouth anda shell of a specific depth. The guide is completed with sleeves supporting drilling and can be manufactured by additive or subtractive CAD/CAM manufacturing processes.



Fig.2. Implant position in relation to anatomical structure

Immediate loading is standard procedure in esthetic zone, when we have appropriate implant stability.

That include impression procedure in different ways: digital (intra-oral scanning) (Fig 3), conventional and extra-oral scanning. Intra-oral and extra-oral scanning request corresponding scan body (implant companies have appropriate scan bodies), that are placed in implant (intra-oral scanning) or implant analog (on plaster model). After scanning procedure digital information can be sent to the lab or in office milling machine, to produce temporary (or definitive) restorations. The blood can be main problem in intra-oral scanning, it cause difficult scanning and numerous deviations. In this case the conventional impression technique in combination with extra-oral scanning is the alternative. Making definitive restoration include scanning or conventional methods. Main problem in intra-oral scanning is copy of emergence profile, because the gingiva is currently collapsing after removing of the temporary crown. [9]Copy of emergence profile on transfer for implant impression is more predictable way for perfect impression. (Fig.4)



Fig. 3. Scan body



Fig.4. Copy of emergence profile

This is standard way in case for one and more then one crowns on implant. Joda et al.introduced atechnique to fabricateindividualized CAD/CAM healing abutment prior touncovering surgery. According to their method, theshape of the emergence profile of the contralateral toothis copied from the DICOM data.After implant placement,digital impression with an intra-oral optical scan isperformed to identify the final three-dimensional position of the implant.Digitally flipped (mirrored) DICOM dataof contra-lateral tooth and the STL-file of the IOS aresuperimposed to fabricate an individualized healingabutment using CAD/CAM from PMMA-based material,which is delivered to the patient at the uncoveringsurgery.[10]Vafiadis et al.introduced adigital fabricating methodfor immediate implant placement and its emergence profile using the preoperative CBCT image.The data obtained is used fabricate acrown-root matrix (resin shell) byCAD/CAM.The matrix is connected with the temporaryabutment intra-orally and used as an immediate provisional restoration. [11]

With the use of digital intraoral impression systems, the complete elimination of a physical model based on a conventional impression is technically possible.[12,13] Master cast can be fabricated using three-dimensional printing systems with a similarly high accuracy. The digital information from the intra-oral scanner can be sent to the printing facility without the risk of losing any accuracy. Thus, the number of manual steps and some physical shortcomings such as distortion of the impression material may be reduced in the fabrication workflow. Different digital intra-oral impressions do not show higher accuracy and precision compared to highly accurate conventional impression systems in-vitro. [12,14] However in everyday practical work with some intra-oral scanner, in the case of scanning a large numbers of scans bodies, there are problems of distortion in the scanned image. (Fig. 5, 6)



Fig. 5. Intraoral scanning

Fig. 6. Real implant positions

The reason for the distortion of the picture may be: saliva, patient moving, humidity, insufficient number of points for joining image algorithms, scanning strategy, etc.

# Conclusion

The results of the previous research show that the digital implant impressions in edentulous patients might still be unreliable due to a lack of stable geometric landmarks.[15] Our clinical experience shows that intra-oral scanning should be applied in case of simple and small reconstructions. In cases of complex reconstruction extra-oral scanning is alternative.

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# **IMPLANT THERAPY IN SOLVING COMPLETE EDENTOULISM**

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# Abstract:

Treating edentoulism with implant therapy is one of the most complex therapeutic procedures and challenges for any clinician. Regarding to anatomical conditions and indication, number of implants and type of prosthesis may vary. Basic difference in prosthetic concept is type of implant loading and it can be alveolar, alveolar-implant and fully implant supported. When loading type is defined, next step is to define type of prosthesis as fixed or mobile. Regardless to type of implant prosthesis, modern implantology become part of big selection of materials and technologies that can be applied. Lecture will show different ways and principles in solving edentoulism with implant therapy.

# MINIMALLY INVASIVE TREATMENTS IN MODERN DENTISTRY-FROM "NO PREP" TO "FULL MOUTH"

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# Abstract:

The demands of patients to the outcome of their dental treatments have changed considerably. A beautiful and healthy smile is increasingly important in modern society.

Thus, new treatment concepts, its strategies and intensive communication with the patient today gain importance in order provide highest treatment results. The knowledge and skills demanded from a clinician are getting increasingly complex and challenging, in demand for regular updates and revisions. Communication, documentation, digital technologies in planning and treatment phase, new trends in implant restorative dentistry are in constant evolution.

The predictable and sustainable long-term success in reconstructive dentistry is the result of an interdisciplinary cooperation and a workflow, which involves periodontal, implantology, orthodontic and especially functional-aesthetic aspects.

For optimal functional and esthetic care, the practitioner must develop an individual master plan based on comprehensive available analogue and digital technologies.

Following such treatment plan where individual therapeutic steps are perfectly coordinated it is possible to conduct even full mouth restoration in minimally invasive and substance-conserving procedures.

# CLINICAL USE OF INTRAORAL SCANNER IN DENTAL PRACTICE

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# Abstract:

A prosthodontic impression is a precise negative imprint or a virtual copy of one or several teeth, their agonists, antagonists and surrounding tissues, providing an accurate interocclusal relation. An impression is a foundation for all the upcoming steps in making a prosthodontic restoration and a key to achieving a good esthetic and functional result. The question frequently asked today is whether the conventional method of taking dental impressions can compete with the digital one, and which one should be considered a method of choice. Digital scanning allows direct registration of the present intraoral condition, as well as the registration of interocclusal relations between the upper and lower jaw both in inaction and in movement, using specific intraoral scanners. Once made, photographs are transferred and converted into a 3D picture, which allows a detailed and precise analysis of the registered condition, software planning and modeling of a future prosthodontic restoration and its 3D simulation. The advantages of intraoral scanning are numerous, the most important ones being its speed (less time required for taking an impression), precision, patient comfort, better control of tooth preparation and anatomic details, facilitated communication with dental technicians and with patients. The main disadvantages of intraoral scanning are: difficulties encountered in detecting the deep subgingival demarcation lines, possible image distortions and the high cost of the required equipment and dentist training.

# THE ROLE OF DENTAL TECHNICIAN IN CONTEMPORARY PROSTHODONTICS

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### Abstract:

The main task of a dental technician is to ensure the best possible aesthetics and function with his prosthetic work. Numerous innovations in technique, technology and development of materials has created various, new solutions of prosthetic rehabilitation. Digital dentistry is any dental technology or device that uses digital or computer-based components instead of older mechanical or electrical methods. Computer-aided dentistry streamlines many processes and removes several formerly manual steps that can now be automated. Introduction of all these things into practice has set up new challenges to a dental technician. Information and learning new skills have become priority and necessary for everyday work. Combine ours daily requirements with new technologies, tailored to a constantly changing world.

# **ESTHETICS – MY WAY**

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Abstract: The concept of Esthetics is perhaps the easiest to explain the meaning of ancient Greek word aisthanomai (feel, observe). Aisthanomai represent the origin of the meaning. Esthetic is the science of art and artistic creativity, and science about beauty an attractiveness, and in every object of observation is trying to find and give beauty. It is also philosophical discipline. Alexander Gottlieb Baumgarten have said that "Esthetics" means "critics of taste". He travs to emphasize the individuality of perception, as also Leibnitz have said: "We do not any rational knowledge about beauty. That whatever means we have some perception and knowledge about it. That perception is based on taste. Somebody will describe something as nice or beautiful, although it is almost impossible to explain that statement. Perception of beauty is something similar to instinct". Every postulates of beauty are representations of its author, from Waldorf's Venus, thru ancient Egypt, Assyria, Greek and Rome to nowadays perceptions of beauty – esthetics. Nor in the modern "Global village" world, "esthetic" or beauty is not equally understood. Mouth and teeth are important factor in esthetic appearance of the individual. Correct position, bright color and nice shaped teeth becomes "must be" in prosthetic reconstructions, and in patients demands. On a series of cases it will be shown some esthetic solutions from very complex rehabilitations and reconstructions of stomatognatic system to minimally invasive solution for therapy.

Key words: esthetics, prosthetic rehabilitation, minimally invasive procedures

# Introduction

The concept of Esthetics is perhaps the easiest to explain the meaning of ancient Greek word *aisthanomai* (feel, observe). Aisthanomai represent the origin of the meaning. Esthetic is the science of art and artistic creativity, and science about beauty an attractiveness, and in every object of observation is trying to find and give beauty. It is also philosophical discipline. Alexander Gottlieb Baumgarten have said that "Esthetics" means "critics od taste". He trays to emphasize the individuality of perception, as also Leibnitz have said: "We do not any rational knowledge about beauty. That whatever means we have some perception and knowledge about it. That perception is based on taste. Somebody will describe something as nice or beautiful, although it is almost impossible to explain that statement. Perception of beauty is something similar to instinct". Every postulates of beauty are representations of its author, from Waldorf's Venus, thru ancient Egypt, Assyria, Greek and Rome to nowadays perceptions of beauty – esthetics. Nor in the modern "Global village" world, "esthetic" or beauty is not equally understood. Mouth and teeth are important factor in esthetic appearance of the individual. Correct position, bright color and nice shaped teeth becomes "must be" in prosthetic reconstructions, and in patients demands.

Restorative procedures must reestablish function, mainly mastication, fonation and esthetics of the sthomatognatic system. Nowadays esthetics is the primary demand of patients. Aperence of "young and beautifull people" is closely connected to tooth form, shape, alignent, brightness and colour. Goal for prosthodontic treatment is to achieve good function with acceptable apearence of restored dentition.

Case 1. Restoring severely worn dentiton



Picture 1. Upper teeth



Picture 2. Lower teeth



Picture 3. All ceramic restorations imediately after cementation



Picture 4. Right side after two years



Picture 5. Left side after two years

# Case 2. Hypoplastic and colored teeth



Picture 6. Upper and lower teeth



Picture 7. All ceramic restorations on both arches

Case 3. Broken incisal edges and shortened teeth



Picture 8. Broken incisal edges



Picture 9. All ceramic partial crowns (veneers) on tooth 12, 11, 21, 22.

#### Case 4. Metal ceramic restorations



Picture 10. Metal ceramic restorations on teeth 12, 11, 21, 22



Picture 11. All ceramic restorations on teeth 13, 12, 11, 21, 22, 23. New look.

This is a short presentation of my idea of ideal dental restorations. All ceramic restoration are ideal for esthetic restorative procedures. Natural look and long lasting restorations are ideal for both patients and doctors.

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# DIFFERENCES IN MOVEMENT OF TEMPOROMANDIBULAR JOINTS IN ATHLETES WITH AND WITHOUT OROFACIAL INJURIES

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### Abstract:

All sporting activities have an associated risk of orofacial injuries due to falls, collisions with players, devices, and hard surfaces. Many authors have reported about incidence of orofacial injuries during sport activities.

In this presentation it will be presented results of investigation on athletes with anamnestic blow to the jaws. Immediately after injury, they have had stiffness/pain of masticatory muscles, pain in region of TMJ, and limitation of jaw movements. All symptoms diminished and finally were gone after some days or weeks after injury. In time of investigation all of them were completely without any symptom of temporomandibular dysfunction according to RDC/TMD protocol, and were completely satisfied with function of their stomathognatic system. To all athlete ultrasound device ARCUSDigma II, KaVo was used for tracing movements of mandibular condile, mandibular movements at the point of mandibular incisors and tracing the paths of movements. Results reveal that injuries of the orofacial system could produce changing of the temporomandibular joints movements and alter the protrusive paths and values of Bennett angle. Altered Bennett angle, without individual settings in articulator, will produce iatrogenic interference during prosthetic therapy, and can during time produce dysfunction of TMJ.

# POSTOPERATIVE PAIN AFTER ROOT CANAL TREATMENT

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**Abstract:** Postoperative pain is a common sensation after endodontic treatment, usually influenced indirectly by temporary restoration left in superocclusion, or directly by mechanical, microbial or chemical irritation of periapical tissue. Intesity of pain depends on the level of destruction of periapical tissue and consequently immunological reaction to it. The mechanical irritation of periapical tissue is most often result of incorrectly determined working length. During instrumentation, infected debris from root canal can be extruded in periapical space, breaking previously formed balance between bacteria and immune system which leads to inflammation. Furthermore, irrigation solutions, intracanal medication and fillings might act cytotoxic by causing a chemical irritation of the periapical tissue.

Key words: postoperative pain, endodontics.

#### Introduction

Pain after root canal treatment is a frequent, uncomfortable complication which has a great impact on the quality of the patients' lives, undermining their confidence in dentist's work. A patient might mistake the occurrence of the post-endodontic pain with poor clinician's skills and knowledge. Prevalence of this undesirable clinical situation, for both patient and clinician, is about 40% in the first 24 hours after completion of endodontic treatment [1]. Giving the information to the patients about potential post-endodontic pain and prescribing analgesics increases the patients' confidence in their dentist, and improves their attitude towards all future dental procedures. The most common odontogenic pain has the endodontic origin, and over 60% of all unscheduled dental visits are represented with a diagnosis of symptomatic irreversible pulpitis and acute apical periodontitis [2]. Mechanical, chemical, or microbial irritation of the periradicular tissue usually provokes its acute

inflammatory response, followed by pain sensitivity, especially when biting down. Flare up can be defined as the occurrence of severe pain usually accompanied by swelling, which typically starts within a few hours or days after root canal treatment, requiring unscheduled, urgent dental treatment.

There are several factors such as age, sex, pulpal, and periradicular status, type of tooth, the presence of preoperative pain, as well as factors under clinician's control including instrumentation, irrigation and obturation protocols that may affect the occurrence of postoperative pain [3]. Well-cleaned, shaped and obturated canal can significantly decrease the apical extrusion of infected debris,

contributing to the lower occurrence of postoperative sensitivity [4]. An in-depth knowledge of those factors helps to control postoperative pain, which is directly influenced by changes in periradicular tissue pressure. The intensity of pain depends on the degree of damage to the periradicular tissue, as well as the severity of the immune response.

To avoid the irritation of periradicular tissue, the essential step in endodontic treatment is an accurate working length determination. For that purpose, analyzing the radiograph by itself is not a reliable method because of image distortion, superimposition of roots, and surrounding anatomic structures [5]. Recently, the use of electronic devices is a simple, and effective alternative that become very popular among clinicians. An inadequate determination of working length can result in insufficient removing of infected root canal dentin. On the other hand, overinstrumentation of the root canal leads to apical extrusion of debris, irrigant or filling materials and consequently to the inflammation of periradicular tissue which is the main reason for the occurrence of postoperative pain after root canal treatment.

# **Risk factors**

Occlusal excess of temporary or permanent filling placed in an endodontically treated tooth causes mechanical irritation and consequently inflammation of periradicular tissue. This is one of the most frequent reasons for the occurrence of postoperative pain after root canal treatment.

According to the several conducted studies, the prevalence of postoperative pain is higher in females compared to male patients. An explanation for this difference can be in changing hormonal status in females during the menstrual cycle, as well as social expectations that male patients rarely report pain sensation in general [6,7]. Postoperative pain after root canal treatment hardly ever occurs in older patients, due to the decreased diameter of the root canal system, and less chance of debris being extruded bellow the apex.

Postoperative pain after root canal treatment of molars is more likely to occur because of the complex root canal morphology of this group of teeth that is more difficult to debride thoroughly [6]. Furthermore, in the patients who take systemic steroids, there is a low postoperative pain rate, due to antiinflammatory effect of this medicaments. The clinical symptoms that existed before root canal treatment started may have an effect on postoperative symptoms. It was concluded that 80% of patients which suffered pain when biting, with spontaneous pain and sensitivity to percussion before, continue to feel pain and after the end of the root canal treatment [8].

# **Microbial irritation**

The main goal of chemo-mechanical preparation of the root canal system is the prevention or the treatment of apical periodontitis [9], which leads to the more predictable success of root canal treatment. Apical third of root canal is the zone with complicated morphology and therefore getting this area completely clean and free of bacteria is difficult to achieve.

Different types of bacteria are found in the root canal, with the predominance of anaerobes. With initiating an endodontic therapy, there is a transition from aerobic to anaerobic conditions in root canal system, followed by the change of the oxidation-reduction potential and to the rapid multiplication of facultative anaerobic bacteria.

Asymptomatic apical periodontitis is characterized by the established equilibrium between bacterial microflora presented in the root canal system and the human immune system in periradicular tissue [10]. This phenomenon is also known in the literature as "local adaptation syndrome" [11]. Extrusion of infected debris in periradicular tissue during root canal instrumentation may break this equilibrium, causing reactive inflammation which intensity depends on the virulence and number of extruded bacteria [12]. On the other hand, if the determined working length is less than it actually is, in the apical third of root canal system, synergistic interaction of residual bacteria will change, followed by activation of their virulence which causes increased inflammatory response in the periradicular tissues [10, 13].

There are two main instrumentation concepts in the root canal treatment: crown-down and step-back technique. According to the study performed by Pasqualini et al, an average amount of extruded debris into periradicular tissue was five times higher by using stainless-steel hand files and applied step-back technique compared to NiTi engine-driven instruments and crown-down technique [1].

# Mechanical irritation

Chemomechanical preparation and obturation of the root canal system should finish at the point of the physiological apex of the root – cementodentinal junction. A half century ago, Langeland estimated that a apical foramen can be positioned at the distance of 0,5-3 mm from the anatomic apex of the root [14]. A favorable point at which cleaning, shaping and obturation of root canal system should terminate for vital cases is about 2-3 mm short or within 2 mm of the radiographic apex for cases of pulp necrosis. Overinstrumentation of the root canal due to incorrectly determined working length causes a destruction of the apical constriction followed by direct mechanical irritation of the periradicular tissue with the endodontic instruments, and increases the possibility for root canal filling to be extruded. This situation can also provide multiplication of bacteria left in the root canal system thanks to the blood that enters the canal which they use as nutrients. Postoperative pain caused by the

inflammation of periradicular tissue can occur even by extrusion of #10 K-file instrument through the apex which is used for determination of working length and/or maintaining apical patency during instrumentation [15].

# **Chemical irritation**

Cytotoxic effect of irrigation solutions, intracanal medicaments or root canal fillings can cause chemical irritation and postoperative pain after their extrusion in periradicular tissue. The more this cytotoxic material enter the periradicular tissue, the more intense reactive inflammation starts. There are numerous factors that increase the risk of sealer extrusion like excessive instrumentation, the complexity of root canal system, application of larger sealer amount, incomplete root development, apical resorption caused by long-term apical periodontitis, warm vertical compaction of gutta-percha, etc...[16]. Sealer extrusion in periradicular tissue leads to their degradation in tissue fluid or phagocytosis. Sealer's cytotoxity is more intense in the initial phase of setting time and declines over time. AH Plus possess low viscosity properties and usually leaks into periradicular tissue during obturation phase, causing the most intense pain occurring in first 8 hours. This indicates on the high cytotoxic effect of this sealer, which also possess Sealapex, Resino Seal and Apexit respectively. AH Plus sealer contains epoxy resin, amines and formaldehyde responsible for cytotoxity of this material [17]. Severe pain after apical extrusion of the sealer requires prompt diagnosis and urgent therapy in order to reduce the risk of permanent nerves damage, especially if the extruded sealer enters mandibular canal [18]. Surgical removing of extruded sealer combined with apicoectomy is recommended in cases of long-term pain after root canal treatment, swelling, paresthesia and when there is a detectable increasing of the periapical lesion.

# Therapy

In study performed by Rosenberg et al. it was concluded that occlusal reduction may prevent postoperative pain in clinical situations when exists intense preoperative percussion sensitivity regardless of the pulpal and periradicular status [19].

Pain subsequent to vital pulp extirpation.

One of the possible explanations for the occurrence of postoperative sensitivity after initial appointment is incomplete removal of pulp tissue. Apart from occlusal reduction, in cases where the radicular pulp tissue is inflamed, it is necessary to re-enter the root canal space and check the accuracy of previously determined working length which will promote more predictable subsequent cleaning from the remaining vital pulp tissue. Intracanal medication should be consider with Ca(OH)2 or even better with Ledermix paste which contains both of antibiotic and corticosteroid effect. The intensity of postoperative pain is usually mild, lasts no longer than 72h and well managed with analgesic from the group of non-steroidal anti-inflammatory agents (Ibuprofen 600mg) and/or Acetaminofen 1000mg singly or in combination [20]. Above all mentioned, patient should be informed about a possible painful tooth sensitivity, which will pass in a day or two.

The main goal of endodontic therapy is removing the all debris from the root canal system. If occurs postoperative sensitivity, after initial root canal treatment, first thing that should be consider is checking the occlusion of treated tooth. If the pain is severe or continues after adjusting the occlusion, root canal must be re-opened, working length should be established followed by copious irrigation with NaoOCl or Chlorhexidine in order to remove left infected debris. An intracanal medicament, primarily Ca(OH)2, should be placed for a week, after which root canal should be obturated if the patient is symptomless. Moreover, if the pain is accompanied with swelling, then drainage should be established either through the apex of the tooth or the soft tissue. Leaving the tooth open is not advisable [21].

# Conclusion

The occurrence of the postoperative sensitivity after root canal treatment is multifactorial and influenced by individual patients' factors, the specificity of the treated tooth and the clinician's skills

and intervention. The knowledge of those factors enable the prevention and an adequate therapy of this inconvenience in everyday clinical work.

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# **RECENT ADVANCES IN PEDIATRIC DENTISTRY**

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Abstract: The field of pediatric dentistry is constantly evolving. When working with kids, comfort, efficiency, safety and conservative treatments are the name of the game. Of course, this holds true for adults too but starting children off on the right foot with dental visits and making the experience stress-free for both patients and parents is especially important. So, what is the future of pediatric dentistry shaping up to be? There has been a technological explosion in pediatric dentistry during the last 25 years. This has been characterized by new and improved restorative materials that allow us to remove less tooth structure. We have finally been able to reach the treatment goals found in delivering more minimally invasive dentistry is kept in the forefront. Especially in pediatric patients, the dentist should focus on the early detection of dental caries and minimally invasive treatment options. The conventional caries detection methods often fail to detect initial enamel lesions that have not progressed to cavitation. For this reason, various new techniques have been developed aiding early detection of caries. The aim of this review is to give general information about recent restorative materials and caries detection methods and to mention their benefits when used in conjunction with conventional methods.

*Key words*: composite materials, glass ionomer cements, fluorescence, spectroscopy, radiography

#### **Review**:

Results from the US National Health and Nutrition Examination Survey[1] show that caries is the most common chronic disease in children. It is 5 times more prevalent than asthma and 7 times more common than hay fever.

The traditional approach to treating caries is to place a dental restoration. The philosophy of "extension for prevention" by G. V. Black was the standard for more than 100 years and could be considered obsolete today[2]. This technique removed an excessive amount of tooth structure by extending the cavity preparation into noncarious grooves. At the time of G. V. Black, there were a lack of techniques, methods, and materials for the prevention of caries, and a lack of proven alternative therapies. Caries were often treated at a more advanced stage. There was a lack of understanding of the caries process, including the demineralization and remineralisation cycle. The primary dental restorative material at that time was amalgam, and the preparation design reflected the need to create retention. Amalgam offers certain advantages such as ease of placement and good compressive strength, while its disadvantages are an unaesthetic appearance, the need for depth and mechanical retention, and its nonadhesive nature.

In the 1990s, there was a shift from a surgical approach of cavity design for dental restorations to a more conservative model. Dawson and Makinson[3] were the first to use the term minimal interventional dentistry (also referred to now as minimally invasive dentistry MID). This model stresses early caries detection and risk assessment, remineralisation of demineralized enamel and dentin, caries prevention, minimally invasive operative procedures, and means to repair rather than replace restorations.

The overall goal is to keep the teeth functional for life. This conservative approach reduces restorative time, reduces pain and stress, and results in less anxiety, all of which are important considerations for the pediatric dental patient.

MID emphasizes the use of adhesive dental materials and techniques. These materials allow for caries removal with a minimal cavity preparation design, which results in less loss of tooth structure. This is because there is no need to incorporate retention in the preparation[4]. One should only remove infected areas that are broken down to the point where remineralisation is no longer possible.

There has been an increase in the use of composites. The reason is an improvement in filler technology and public demand for more aesthetic restorations[5].

Unlike amalgam, composites offer many advantages. First, one can create smaller cavity preparations which result in more remaining tooth structure. Secondly, there is less need for mechanical retention[6].

Roughly three major periods can be distinguished in the timeframe of composite development so far: (1) mid 1960's – late 1970's with major changes in the curing characteristics (from self- and UV-cured to visible light-cured composites); (2) late 1970' – mid 2000's with various filler modifications (from macro and micro-filled to hybrid and nano-filled) and (3) mid 2000's – mid 2010's with important resin modifications (from methacrylates to high molecular weight modified methacrylates, siloranes and self-adhesive composites).

Glass-ionomer cements have been used in restorative dentistry over more than forty years. They appeared as a result of the early studies of Alan Wilson and Brian Kent in the Laboratory of the Government Chemist in London by the late 1960s[7]. In 1972 Wilson and Kent produced the first glass with a high percentage of fluoride (G-200). This cement was originally called ASPA, an acronym of Alumino-Silicate Polyacrylic Acid. However, the first glass ionomer, ASPA I (De Trey Division, Dentsply International) set sluggishly, was susceptible to moisture while setting and had a very low translucency, and met with a limited use by the clinician. Later on more advanced brands of GICs appeared: ASPA II (addition of tartaric acid) – Wilson and Crisp, 1972; ASPA III (methyl alcohol in polyacrylic acid) – Wilson and Crisp, 1974, and ASPA IV (copolymer with acrylic and itaconic acid) – Crisp and Wilson, 1977. This glass-ionomer cement was the first commercially marketable cement, although its characteristics were quite inferior in comparison with current materials[7,8,9].

The original glass-ionomer cements are composed of a water solution of poly(acrylic)acid in a concentration of about 45%, which enters into a reaction with a powder composed of calcium fluoraluminosilicate glass. This glass is of the same generic type that was used in the old dental silicate cements[7,8,10,11,12].

Glass-ionomer cements can be divided according to several criteria. The chemical classification of glass-ionomer cements is the most important one. According to this classification GICs are commonly classified into five principal types: conventional glass ionomer cements, resin modified glass ionomer cements, hybrid ionomer cements or resin-modified glass ionomers or dual-cured GICs, tri-cure glass ionomer cements and metal reinforced glass ionomer cements or cermets.

The composition and the chemical reactions of GICs are basically equal for all categories, with some variations in the power/liquid ratio, as well as in the particles size which are adapted for different purposes. GICs possess particular characteristics which make them attractive for dentists. They bond adhesively to dental hard tissues, release fluoride for a relatively long period, and they are also biocompatible and have similar thermal expansion coefficients as the dental structures. In spite these advantages, conventional GICs have also some disadvantages as follows: short working time and relatively long setting time, brittleness, low fracture resistance, low resistance to abrasion and wear. They are sensitive to moisture inhibition during the early setting reaction and to dehydration as well. Some of the disadvantages have been improved in the most recent GIC generations. It is well known that mechanical and physical-chemical characteristics, as well as the working and setting times of GICs depend on several factors like: the composition of the aluminosilicate glass and the polyacrylic acid, the size of the particles in the glass powder, the proportion of the elements in the composition (glass/polyacrylic acid/tartaric acid/water), and the mixing process. During manufacturing of GICs, almost all process are controlled, except the mixing process[10,11,13,14,15,16].

#### Detection and diagnosis of dental caries

Early detection and diagnosis of dental caries reduces irreversible loss of tooth structure, the treatment costs and the time needed for restoration of the teeth. Dental caries often initiates at the fissures in the occlusal surface of the tooth. Conventional examination for caries detection is primarily

done using visual inspection, tactile sensation and radiographs. While these methods give satisfactory results in detection of cavitated lesions, they are usually inadequate for the detection of initial lesions. Because of these deficiencies, new detection methods have been developed to aid better diagnosis.

#### **Visual Inspection**

It is one of the most common diagnosis methods implemented by dentists. In order to make an accurate assessment, the teeth should be clean, dry and examined under a light source. In visual examination, changes in tooth structure such as; enamel dissolution, white spot lesions, discoloration, surface roughness and presence of cavitation are assessed. When illuminated, the carious tissues scatter the light and make enamel look whiter and opaque. This is due to increased porosity caused by demineralization. Similarly, when dentin undergoes demineralization, a shadow is observed under the intact enamel. When caries progress, the surface breaks down and a cavitation is formed[17].

### Radiography

Radiographic examination has great value in detecting caries lesions especially when they are not clinically visible. In low caries population, as a result of fluoride use, the surface of enamel does not break down, making the caries detection harder. In recent years, the incidence of such lesions has increased dramatically[18]. According to studies, bitewing radiography has been proven to be an effective method in the detection of proximal caries and hidden caries[19].

#### **Digital radiography**

This is a form of X-ray imaging, where digital X-ray sensors are used instead of traditional photographic film. Advantages include time efficiency through bypassing chemical processing and the ability to digitally transfer and enhance images. Also, less radiation can be used to produce an image of similar contrast to conventional radiography. Instead of X-ray film, digital radiography uses a digital image capture device. This gives advantages of immediate image preview and availability; elimination of costly film processing steps; a wider dynamic range, which makes it more forgiving for over- and under-exposure; as well as the ability to apply special image processing techniques that enhance overall display quality of the image.

#### **Digital subtraction radiography (DSR)**

DSR is a more advanced image analysis tools. This method allows professionals to distinguish small differences between subsequent radiographs that otherwise would have remained unobserved because of overprojection of anatomical structures or differences in density that are too small to be recognized by the human eye. The procedure is based on the principle that two digital radiographic images obtained under different time intervals, with the same projection geometry, are spatially and densitometrically aligned using specific software. Digitalization is done by taking a picture of the radiograph with a high-quality video camera. This image is transferred to a computer imaging device named as digitizer. Two standardized radiographs exposed to same amounts of beam are superimposed using a software. The difference between the two images looks as dark bright areas. This technique is extensively used for detection of caries and assessment of bone loss in periodontology[20].

#### Transillumination

Because all teeth are translucent, they have specific optical properties and caries detection using a light source is not a new concept[21]. In 1922 .Dr. William John Cameron published his work: Diagnosis By Transillumination: A Treatise On The Use Of Transillumination In Diagnosis Of Infected Conditions Of The Dental Process (1922)[22]. In it, he states, that this use of transillumination provides one of the most valuable aids in operative procedures. It can be used effectively for the detection of interproximal caries and intercoronal caries. Caries will at once evidence themselves by a distinct discoloration in the crown of the tooth covering the area affected or filled. Transillumination is but one diagnostic technique that uses light for detecting hidden caries. Light source technology and result interpretation and recording has evolved to include laser caries detection through fluorescence, light emitting diode spectroscopy, fiber-optic transillumination, and optical coherence tomography among others.

**Fiber Optics Detection (transillumination)** of a carious lesion is based on changes in scattering and absorption of light photons traveling through the carious lesion which can be observed by the clinician as a dark shadow. An intense light using fiber-optic technology greatly enhances detection ability. Methods using this intense light source are referred to as FOTI (fiber-optic transillumination) or DIFOTI (digital imaging fiber-optic transillumination), which operates under the same principle as FOTI but allows for the saving of digital images of the transilluminated tooth. In the literature, most studies have focused on transillumination as a method to replace radiographs with varying performance[23,24,25,26,27].

**Microlux Transilluminator**<sup>®</sup> (Addent, Danbury, CT) is used for detecting anterior and posterior caries. Using a 2 or 3mm light guide, it also helps to visualize crown fractures, root canal orifice, and root fractures. The fiber optic probe is placed adjacent to the oral structure under examination and the passage of the light through the tissue is proportional to the translucency of each material. Caries, calculus, cracksand the orifice of root canals do not transmit as much light as healthy enamel or dentin and appear darker[28].

**DEXIS CariVu**<sup>TM</sup> is a compact, portable caries detection device that uses patented transillumination technology to support the identification of occlusal, interproximal and recurrent carious lesions and cracks[29,30].

Expanding on the developments in FOTI and DIFOTI which use visible light, a new technology has emerged that uses near-infrared light (NIR) for transillumination of the tooth. The **DIAGNOcam**<sup>®</sup> (KaVo, Biberach, Germany), introduced in 2012, is a camera system that employs a NIR light source. The light is transmitted through the gingiva, alveolar bone, and root, then up through the crown. Presence of a carious lesion will scatter and reduce the transmitted light. A charged-coupled device sensor captures the clinical data and displays an image of the tooth viewed from its occlusal surface. With KaVo DIAGNOcam<sup>®</sup>, light waves replace X-rays otherwise needed for caries detection, giving exceptional image quality and detail. Benefits include early diagnosis of occlusal, approximal, smooth surface, and secondary caries and cracks.

### Fluorescence

Other method used for caries detection is based on optical properties from sound and carious dental tissues. Fluorescence is a phenomenon where the light is absorbed in a specific wavelength and then emitted in a higher wavelength. This characteristic has been observed in the dental tissues, since the pattern of light absorption and reemission (spectrum of fluorescence) of the dental tissues varies according to the excitation light wavelength[31]. The natural fluorescence of hard dental tissues has been studied since long time ago. It is well known that as the enamel as the dentin shows an auto-fluorescence. Thus, light absorption and reemission is different in the enamel, dentin and cementum, as well as in sound and carious tissues. For this reason, fluorescence can be used for the detection and subsequent diagnosis of dental caries. Caries lesions, dental plaque and microorganisms also show fluorescent components. It has been observed that the difference between natural fluorescence of sound and carious dental tissues can be quantified using light-emitting devices, such as laser, xenon or LED.

#### Light-emitting devices

#### Laser

There are a number of different devices for detecting caries through the use of lasers[32]. Laser is the most popular devices detect caries through the use of fluorescence. Normal healthy tooth structure produces little or no fluorescence. Carious tooth structure will fluoresce proportionate to the degree of caries. Some of these early devices were highly sensitive to caries but had a low specificity. This low specificity meant that these devices would measure the fluorescence of anything. However, with contemporary advancements in laser technology, that specificity has improved and caries can be diagnosed in a more precise manner. Laser fluorescence device is a non-invasive and quantitative method based on the laser induced fluorescence. The first laser fluorescence device, **DIAGNOdent** 2095<sup>®</sup> (KaVo, Biberach, Germany), was developed in 1998[33,34,35,36].

# The Canary System<sup>®</sup> (Quantum Dental Technologies Inc.)

The Canary System<sup>®</sup> is a low-powered laser that detects caries not yet discernible on x-rays or by exam. It detects decay, cracks and defects by examining and measuring crystal structure breakdown. Lesions as small as 50 microns and up to 5 mm below the tooth surface can be detected. Canary exams provide audible and visual feedback that engage patients[37].

### LED fluorescence device

**Spectra - The Spectra Caries Detection Aid System**<sup>®</sup> (Air Techniques, Inc., Melville, N.Y.) is another fluorescence-based caries detection system. The technology used is similar to that of the DIAGNOdent. Spectra uses six light-emitting diodes (LEDs) to project a blue-violet wavelength of 405 nm. The system connects to a computer via USB port and uses software analysis to determine the level of caries involvement. The Spectra has two modes: detection and analyze. The detection mode is displayed in color. Healthy enamel is green while caries appears as red. In the analyze mode, the software provides numerical values. The values are as follows: 1.0 indicates early enamel caries, 1.5-2.0 denotes deep enamel caries, 2.0-2.5 indicates dentin caries, and 2.5 and higher signifies deep dentin caries. The Spectra wand is handheld and portable, and an autoclavable rubber spacer fits over the lens. The spacer must be in contact with the tooth to produce consistent images. Images can be saved for monitoring. The device is self-calibrated, but the tooth must be dried thoroughly. Spectra can detect recurrent decay around existing amalgam and composite restorations[38,39].

# VistaProof<sup>®</sup> (Dürr Dental, Bietigheim-Bissingen, Germany)

Another device based on the light-induced fluorescence phenomenon is the intraoral camera VistaProof<sup>®</sup> (Dürr Dental, Bietigheim-Bissingen, Germany) that is based on six blue GaN-LEDs (Gallium-Nitride-Based - LEDs) emitting a 405-nm light. With this camera it is possible to digitize the video signal from the dental surface during fluorescence emission using a CCD sensor (chargecoupled device). On these images, it is possible to see different areas of the dental surface that fluoresce in green (sound dental tissue) and in red (carious dental tissue)[42]. Software is used to analyze the images and translate into values the intensity ratio of the red and green fluorescence. According to the manufacturer, those values are related to the lesion extension. The higher is the bacterial colonization, the higher is the red fluorescent signal. The software highlights the lesions and classifies them in a scale from 0 to 5, giving a treatment orientation in the first evaluation: monitoring, remineralization or invasive treatment. However, these values still need to be adjusted[35,43]. Recently, this device showed a good performance in detecting and quantifying dental plaque formed over smooth surfaces under high exposition to sucrose[44].

# D-Carie mini<sup>TM</sup> (Neks Technologies Inc)

This device is a lightweight, easy-to-use, cordless device that can be used as an aid for clinicians to quickly locate and diagnose caries. The D-Carie mini uses Light Emitting Diode (LED) and fiber optic technologies to accurately detect both occlusal and interproximal caries[45,46].

**Soprolife**<sup>®</sup> (Acteon Imaging, La Ciotat, France) is a light-induced fluorescence intraoral camera system. Soprolife<sup>®</sup> uses two types of LEDs to illuminate the tooth and evaluate changes in mineral density[47]. Images can be captured in three different modes: daylight, diagnosis, and treatment. The daylight mode uses a high-level magnification intraoral camera illuminated with white LEDs. The diagnosis and treatment modes use fluorescence via four blue LEDs at a 450 nm wavelength[21]. The second light is directed at the tooth surface and produces a superimposed image over the white light image, a phenomenon known as auto fluorescence. Soprolife uses a color-coding system. Green fluorescence is considered an indicator of healthy tissues, and red fluorescence indicates a carious lesion. The treatment mode can be used as a guide during cavity preparation. Images can be saved for future comparisons.

Quantitative light-induced fluorescence (QLF) was first introduced in 1995. This new technology was developed based on the optical phenomena of fluorescence and allowed a quantitative measurement to be calculated in the difference in fluorescence radiance between carious and sound tooth structure. This technique is based on the principle that as the mineral content of the tooth changes the auto fluorescence of the tooth changes also. The light scatters much faster in carious tissues compared to sound dental tissues, shortening the pathway of the light in the lesion and decreasing the absorption and fluorescence in this area. This means that, the scattering of the light is

used for evaluating the mineral loss related with the lesion40. The QLF method can also be used in measuring the red fluorescence from microorganisms in plaque. The value of red fluorescence can be used in the evaluation of oral hygiene, assessment of the plaque on the dentures, detection of the infected dentin and detecting the leakage of a sealant or caries at the margin of a restoration. The QLF method was suggested as an efficient technique not only for the detection early caries but also monitoring the progression of a lesion or remineralization process[40].

In 2004 the first commercial QLF device was marketed under the name **Inspektor Pro** (Inspektor<sup>TM</sup> Research, Amsterdam, Netherland). In 2012 a newer QLF device was released by the same company under the name QLF-D Biluminator 2 (Inspektor<sup>TM</sup> Research). Inspektor Pro, utilizes a light box that contains a blue-green arc-lamp with wavelengths of 290 nm to 450 nm with peak intensity of 370 nm. The excitation light travels to an intraoral wand by fiber optic cable. The wand also contains a charged coupled device (CCD) camera covered with a bandpass blue filter. The components are connected to a computer where a two-stage process occurs: 1) Capture of the images using the intraoral camera, and later, 2) Analysis of the images using proprietary software to quantify mineral loss of green fluorescence. Inspektor Pro software does not quantify the red fluorescence.

The most recent QLF device, **QLF-D Biluminator 2** is based on the same principle of green and red auto-fluorescence as described earlier. The equipment of QLF-D Biluminator 2 is quite different from that of Inspektor Pro. QLF-D Biluminator 2 utilizes an extra-oral digital single lens reflex (DSLR) camera rather than an intraoral camera. The QLF-D Biluminator 2 camera is fitted with a 60-mm macro lens and a 17 modified filter set. The light source is replaced with two sets of blue and white lightemitting diodes (LED) mounted on a ring around the lens surrounded by a metal tube. White LEDs are used for standard white-light images, while the set of narrow-spectrum blue light LEDs of a peak wavelength of 405±20nm provide the excitation fluorescent light. In a similar way to Inspektor Pro, QLF-D Biluminator 2 camera is connected to a computer that runs the necessary software for archiving images and analysis. The process of performing analysis is also carried out in two stages similar to Inspektor Pro, but because of the modified set of filters in QLF-D Biluminator 2, captured fluorescent images no longer look green, compared with Inspektor Pro, but have a whitish appearance instead. Acquired images are captured and later analyzed using advanced proprietary software to quantify both green and red fluorescence.

#### Endoscopy

This technique works with the principle of observing the fluorescence that occurs when the tissues are illuminated with a blue light that has a wavelength of 400-500 nm. The changes in the fluoresced tooth structure is viewed through a specific gelatin filter; white spot lesions appear darker than sound enamel. Similarly, when a light source is connected to an endoscope by a cable, the teeth can be viewed without a filter. This technique is called white light endoscopy. It has been demonstrated that this technique gives efficient results in the detection of early carious lesions[41].

#### Spectroscopy

#### Alternating current impedance spectroscopy

**CarieScan PRO**<sup>®</sup> (CarieScan, LLC) is a device that utilizes the technology of alternating current impedance spectroscopy. It relies on the theory that sound dental hard tissue exhibits high electrical resistance or impedance, whereas the more demineralized the tissue, the lower the resistance becomes. The device is intended to detect and monitor primary coronal dental caries at an early enough stage to support preventive treatment. It cannot be used to assess secondary caries or root caries[48]. Uses ACIST technology determination of both healthy and carious teeth is with 92.5% accuracy.

**Sound waves** can be used for the detection of caries. Ultrasound can detect lesions easily because the travel time of ultrasonic pulses differ in sound and demineralized enamel tissues[49,50]. This method is considered promising in detecting early enamel lesions because the white spot lesions confined to enamel produce no detectable or weak echoes whereas deeper lesions produce substantially higher amplitudes[51].

#### **Cone Beam Computed Tomography**

This technique is a new application of CT. The absorbed doses and the costs are significantly lower than CT. The information from the craniofacial region are obtained at higher resolutions at axial plane compared to CT systems[53]. In dentistry, there are many studies showing that cone beam CT (CBCT) is widely used in the placement of implants, grafting, orthodontic treatment planning, evaluating the temporomandibular joint, detecting anatomic variations, evaluating trauma patients, caries detection[54].

#### **Optic Coherence Tomography**

This technique uses a high penetration near infrared light at a wavelength of 780-1550 nm. No potential biological side effects had been reported of this system so far[55]. Optic coherence tomography (OCT) generates high-resolution cross-sectional images of the oral structures. OCT is found to be more sensitive in the detection of recurrent caries and evaluation of the marginal adaptation of the restorations compared to other tools. Like ultrasonics, OCT uses near infrared emissions to determine not only the presence of the caries lesions but also measures the depth of them. Another important advantage of this technique is that the patient is not exposed to X-rays[55].

### **Terahertz Imaging**

This method uses waves in terahertz frequency  $(10^{12} \text{ Hz or a wavelength of 30 } \mu\text{m})$ . This wavelength is short enough to provide reasonable resolution but long enough to prevent loss of signal due to scattering[55]. Several advantages of this system are as follows: human tissue is relatively transparent to terahertz rays, low powers are used for imaging, non-ionizing radiation is used, the electrical charge of the tissues examined remain unchanged, the images are clear but due to long wavelength of the source spatial resolution is low. Studies concerning this method of imaging are limited but promising.

#### **Multiphoton Imaging**

Infrared light of 850 nm wavelength is used in this imaging technique. While conventional fluorescence imaging uses a single blue photon to excite fluorescence compound of the tooth, multi photon imaging uses two infrared photons (with half the energy of the blue photon) which are absorbed simultaneously[55]. With this technique, sound tooth structure shows strong fluorescence whereas carious tissues fluoresce weaker. The carious regions appear as dark areas in strongly fluorescing tooth[55].

### **Tuned Aperture Computed Tomography**

This technique was recently introduced and is still under development. The image produced with this technique is the three-dimensional image of the original object. Detection of demineralization and vertical root fractures is possible with this method[52]. Compared to present detection tools used, tuned aperture computed tomography (CT) has a promising future for the detection of recurrent caries. It is possible to slice the coronal anatomy into pieces and observe the interested region. The main advantage of this technique is that it offers the examination of individual projections of an area[51].

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## **Full Papers**

### FABRICATION OF COMPOSITE VENEERS WITH FABRIC MOLDS MADE IN ONE VISIT

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Abstract: This paper presents the case of developing composite veneers with the help of the factory molds. The introductory part of the work deals with the elaboration of the concept of "composite veneers", types (composite and ceramic), indications and contraindications in the application in dentistry. The central part of the work shows the specific case of composite veneers. In this part of the paper, are detailed all the concrete steps describing the processes for using GC Gradia Direct LoFlo composite, which is a high viscosity liquid filled micro-hybrid composite with HDR (High-Density Radiopaque). The final part of the work, the conclusion stands out the potential advantages of composite veneers in dentistry, such as reduces of working time (one visit dentists), the receptivity in terms of color and shape of teeth, the possibility of repetition and implementation procedure without tooth preparation and affordability for the patient.

*Keywords:* composite veneers, ceramic veneers, restorative procedure

#### Introduction

Veneers are used by the 20-is of the last century. With the development of technology and the improvement of the quality of the material, there was a significant enhancement and improvement of the characteristics of veneers. Veneers are extremely thin flakes, whole compensation of vestibular tooth surfaces, which give the impression of its characteristics and appearance of natural tooth enamel. In contrast to the crown, where it is necessary to remove a major part of the dental tissue, the application of veneers requires a minimally invasive method in dentistry. It is important to note that today the use of a special type of veneers that do not require preparation of teeth in the form of grinding or removal of tooth substance.

If we for the subject of observation take a natural tooth where the light passes through its surface, which is called enamel, we will notice that the aforementioned light reflected from the layer of the tooth (dentine-a), what makes an impression of natural-looking teeth.

Lack of crowns, which are made of special opaque porcelain veneers in relation to the leaking light, lies in the fact that faceted teeth have a natural look. The light that passes through the facets reflected from the cement which is cemented, which creates an effect like a real tooth.

Numerous cosmetic dentistry problems can be successfully solved using modern veneer. Depending on the material from which they are made, it is possible to distinguish between the ceramic and composite veneers. Ceramic veneers are made of a ceramic material that is hard and brittle, and therefore show a high value of compressive strength, low value of tensile strength, but it is significant and that biocompatible and chemically stable.

We can say that the ceramic veneers have become an alternative to ceramic and metalceramic crowns. Due to its aesthetic qualities, the correct techniques and application of adhesive cement today they represent a solid and long-term compensation. Ceramic veneers are made in the laboratory, and dental technology. For their use needed is minimal tooth preparation in the enamel level, thickness 0,3-0,7mm. This is a painless procedure, after which an impression of the upper and lower dental arch. At the next visit, the patient is cemented finished ceramic veneers. Ceramic veneers achieve natural-looking teeth. Its smoothness and strength of this venners on the tooth does not change color over time. Unlike ceramic veneers, composite veneers can be done and finish in one visit. There are two ways of making composite veneers, by applying the factory fabricated composite veneers or their direct production in the patient's mouth with the aid of composite materials.

Direct composite veneers snippets showing good results in cosmetic dentistry today [1]. In addition to these time savings when placing composite veneers that are done in one visit, for ceramic veneers are required at least two visits, as well as significantly less removal of tooth substance, or if directly made not require preparation, which represents some of the basic items favor the use composite veneers.

Preparation for indirect ceramic restoration, resulting in a significant loss of tooth substance than for the direct preparation composite veneers [2]. Economically, the price of a single composite veneer is significantly lower and therefore significantly more acceptable to patients.

Therefore, applying direct composite veneers can always be repaired and subsequently change the desired shape and color of the tooth. Direct composite veneers have a more significant role in dental clinical use, accompanying the recent development of materials and techniques in the case of adhesive and restorative dentistry [3].

The lifespan of composite veneers at correctly applied the techniques of setting with the proper attitude towards hygiene and veneers and teeth, an estimated three to five years, while for ceramic veneers and longer duration is ten years.

Progress with new nano-composite materials and adhesive systems proved stronger bond with hard tissue of the tooth as well as the opportunity for lower preparation of [4,5]. Indications for veneers are when we want to:

- make up for broken or damaged coronal portion of teeth (due to erosion, attrition, abrasion, malformations),

- change the shape of teeth,

- change the color of teeth with stains and discoloration if treatments for whitening teeth did not help, as well as tetracycline stained teeth,

- close the diastema between teeth.

State where it is not suitably applied facets, as well as therapeutic choices are:

-teeth with large cavities,

-teeth with active disease the right (where the necessary repairs and previous treatment), patients with -at malposition of teeth, and a deep reverse conversion teeth (wherein requires orthodontic treatment),

and -at patients with bruxism,

-bad oral hygiene,

-large destruction of the coronal part of the tooth (crown is indicated here).

#### **Case report: Direct composite veneers**

Patient aged 40 years, visited the clinic because she wanted to change the appearance of her teeth in the frontal region. Clinical examination of the front upper teeth 13, 12, 11, 21, 22, 23, where noted the inadequate restoration.

The patient was not satisfied with the appearance and color of her front teeth. It was decided to create direct composite veneers with the use of the factory molds. It was used Ultradent Veneer moldings - Figure 1. This is a set of factory fabricated mold made of acrylic with a corresponding shape of the tooth, the size L (large) and M (medium) (depending on the patient's tooth), with a range of the mold teeth 14 to 24 and the lower jaw 34 to 44. in this case, M is applied to the tooth size of the mold which corresponds to the size of the other teeth - Figure 2.





Figure 1.Set factory mold veneers

Figure 2. The setting of the mold to the tooth

After cleaning the teeth, determined by tooth colors under the daylight - Figure 3. they are then removed from the teeth inadequate fill 12 and 13 (range V). Teeth are made individually, and adjacent the teeth were isolated with Teflon tape. A tooth that has been the subject of work, was treated with a 35 percent solution of phosphoric acid for 30 seconds, and thereafter was washed with water. Then, on the surface of the tooth was applied G Bond adhesive resin, which is then polymerized dryish and 20 seconds.

In this case, it was used GC Gradia Direct composite LoFlo. The above-mentioned composite is a high viscosity liquid filled micro-hybrid composite with HDR (High-Density Radiopaque) that gives it high physical properties. On the tooth is applied in a thin layer composite Gradia Direct LoFlo, and after that, it was applied to the mold factory. Because of the state of low flow composites, it is molded to the shape of the future tooth. Due to its pronounced physical properties, which are very similar to standard composite resins, veneers are stable over a long period of time.

Then the tooth was placed with a mold made in a polymerization period of 40 seconds. The process was repeated with the remaining teeth. Interdental tapes, discs, and rubbers have made definite finishing and polishing teeth - Figure 4.



Figure 3. Teeth before procedure



Figure 4. Front teeth with veneers

#### Conclusion

Modern aesthetic dentistry today use a variety of alternatives, depending on the fact that whether it is a simple or complex case. Before choosing a cosmetic restoration, it is necessary to properly define the indication of the precise determination of the diagnostic target. It is important to choose the right procedure and therapy for each individual patients. The clinical technique presented in this case indicates the use of direct composite veneers that represent a quick and simple tooth restoration with excellent aesthetic results and economically acceptable for patients.

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## THIRD AGE PATIENTS BEFORE AND AFTER REMEDIATION BY PROSTHODONTIC PROCEDURES

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**Abstract :** *Introduction.* Republic of Serbia, with approximately 16% of its population over the age of 65, is demographically ranked among the countries with the oldest population in the world. This imposes a demand on all of us to comprehensively observe a population that is increasingly numerous and to be more accessible to all types of health care and therefore dental health care.

*Objectives.* The main goal of this study was to determine the stomatognathic system in patients of the third age before and after prosthodontic remediation.

*Methodology.* In this paper, the applied research was done according to the principle of selection of patients (third-life), with their consent to participate in this study. The therapeutic protocol was the same for all patients stratified by age.

**Results**. All the results obtained during this study are presented, although in the professional public it is a well-established practice to present only successful and positive results of individual research. We can rarely read about those less successful results – unwanted for publication. All results will be presented in tables and graphs in the lecture, and *in extenso* in the paper.

*Conclusion*. This study raises a very important question when it comes to patients of the third age. When we take into account all the above data, indications, contraindications, desires and possibilities for geriatric prosthodontic rehabilitation, we can freely say, that the results are alarming, since almost 50-65% of patients - examinees were partially or completely edentulous and gerontoprosthetically untreated.

#### Key words : Prosthodontics, Stomato-prosthetic remediation, Geriatric dentistry

#### **INTRODUCTION**

Republic of Serbia, with approximately 16% of its population over 65 years of age, is demographically ranked among the countries with the oldest population in the world. This imposes on us a demand to comprehensively observe a population that is increasingly numerous and to be more accessible to all types of health care, including dental health care. As in all living beings, human body physiology undergoes the stage of aging, which is a unique process in every individual, and cannot be uniformly observed in any aspect, except that an age limit has been set, and that is 65 years of age. Numerous factors determine the rate of the aging process. The changes affect soft tissues, but also the hard tissues in the oral cavity. The changes may be the result of various factors, from food types to oral hygiene, the presence or absence of natural teeth and their condition, as well as whether the patients used fixed or removable dental prostheses at an earlier age or are using them now. Geriatric dentistry is a team work that includes a medical doctor specializing in a specific field, a dentist and

medical/dentistry nurses<sup>1</sup>). In elderly patients, there is a frequent presence of comorbidity, i.e. of several diseases and conditions that require comprehensive diagnostics and treatments. It is therefore necessary to take in consideration the patient's general condition, impaired sight, neurological diseases, the loss of arm coordination, psychological condition and reduced saliva secretion, either due to aging or to the usage of medications in the therapy of certain diseases. The latter may result in poor oral hygiene, xerostomia, ulceration, fungal diseases, increased dental plaque, tooth decay, especially deep decay, abrasion in the remaining teeth, dental substance fractures, bleeding, with the

outcome of paradontopathy and tooth loss or extraction<sup>2</sup>). Ultimately, the lack of teeth and weakened muscular activity may make the patient avoid food or swallow it without chewing, which leads to the changes in the upper parts of the gastrointestinal system (increased secretion of H receptors, gastrin and gastrointestinal hormones). The ultimate outcome is malnutrition, i.e. conspicuous decrease in body weight<sup>10</sup>).

#### **OBJECTIVE**

The main goal of this study was to determine the state of the oral cavity in third age patients before and after prosthodontic remediation; whether the patients had earlier history of stomatognathic system problems and whether they replaced their lost teeth in due time by removable or fixed prosthodontic devices.

Based on the anamnestic data obtained from the patients or their caregivers, on the clinical examination of the patients' oral cavities and additional diagnostics, the therapeutic plan was made for the remediation of the patients (mobile, semi-mobile and mobile persons). These procedures were conducted with the goal of successful prosthodontic remediation and general improvement of health in elderly patients.

#### **RESEARCH METHODOLOGY**

The research was conducted by selecting third age patients-participants, with their consent to participate in the study<sup>4</sup>). Remediation protocol was the same in all patients, who were stratified into three age groups. The protocol involved gathering anamnesis, obtained from the patients or their caregivers. The patients then underwent clinical examination (extraoral and intraoral examination). After that, plans of treatments were designed prior to geriatric prosthodontic remediation.

The first group was aged 65 to 75, the second 75 to 85, and the third group, which was the smallest, over 85.

Patients with chronic diseases (cardiological, neurological, endocrinological, gastroenterological, hematologic and other) had to provide written consent from their long-term medical specialist in order

to be included in the remediation procedure<sup>5</sup>).



Fig 1.



Fig 2.





Geriatric prosthodontic remediation was performed by removable dentures, complete, partial or fixed prosthodontic procedures, most frequently involving the combination of removable and fixed dentures.

The remediation procedure included the total of 253 patients, 98 (38.73%) of whom were male, and 155 (61.26%) female.

During the clinical examination, it was found that the total of only 21% participants of both genders had been previously stomatologically remediated, while the rest of the participants were in need of any type of remediation.

80% of the patients had the following problems:

- inability to be treated in their place of residence;

- distance and additional cost of transportation;

- having been declined by their stomatologist in charge to provide examination and aid, and proceed with prosthodontic procedures;

- having been sent to larger centres for treatment, with a referral that had to be re-validated, in the place of residence.

A lesser part of the target group, mostly immobile and bed confined patients, required a longer period

of time<sup>6</sup>). Approximately 25% of the 253 patients examined did not receive appropriate basic dental care (close to their place of residence). Such a discriminatory attitude of certain stomatologists deprives patients of appropriate geriatric prosthodontic care close to their place of residence and increases the cost of medical care.

The latter case can be interpreted in several ways, either as inadequate motivation of the stomatologists or their insufficient knowledge and skill of communication with patients of this age group.

#### **RESULTS OF THE STUDY**

In the subsequent section we present all the results obtained in the study, despite the common practice to publicize only successful and positive results in the expert community. We can rarely read about those less successful results – unfavourable for publication. In reality, unfavourable results are equally worthy of publication, since they motivate us to do our best and compare our results with those of other authors-researchers, in the country and abroad, and lead us to advance our practice and

scientific research and promote human health care<sup>7</sup>).

As was stated in the research methodology section, our study included 253 patients, aged from 65 to over 85. It included both genders, 155 female (61.5%) and 98 male (38.73%) patients.

Before the prosthodontic procedure, the participants of both genders complained about the following: - tooth pain -253 patients

- pain in the temporomandibular joints female patients 70
- loose teeth -253 patients
- inadequate dentures (unstable or loose) -62 female, 60 male patients
- difficult and impaired speech 43 patients of both genders
- difficulty taking food and chewing 170 patients of both genders
- missing control appointments/corrections 78 female and 60 male patients
- pain in the stomach after taking a meal (food insufficiently chewed) -69 patients of both genders
- psychological anxiety (withdrawing from society) 98 female and 10 male patients.

Before the remediation, partially or completely edentulous patients had used removable dentures from 8 to 17 years, but there were also patients who had used dentures over 20 years. Those with fixed prosthodontic devices had used from 5 to 10 years, and a lesser group had them between 10 and 15 years, or even longer.

After the treatment of soft and hard remaining tissues in the oral cavity, 48% of the patients of both genders were treated with complete dentures in both jaws.

25% of the patients of both genders were treated with one complete and one partial denture.

23% of the patients of both genders were treated with partial dentures in both jaws.

4% of the patients of both genders were treated with fixed dental prostheses (crowns and bridges) (Table 2).

Table	1
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GENDER	AGE	NUMBER	PERCENTAGE	
female patients	65-75 years	88	34.78%	
female patients	75-85 years	65	26.69%	
female patients	over 85 years	2	0.79%	
male patients	65-75 years	69	27.27%	
male patients	75-85 years	25	9.88 %	
male patients	over 85 years	4	1.58%	

After the treatment of soft and hard remaining tissues in the oral cavity, the patients were treated in the following way:

Table 2					
With complete dentures in both jaws	With one complete and one partial denture	With partial dentures in both jaws	With fixed prostheses (crowns and minor side bridges)		
48%	25%	23%	4%		

Special care should be taken with semi-mobile and immobile patients, regardless of whether they are institutionalized or not.

Also, much more attention should be taken to provide appropriate training to dentistry doctors for work with third age patients, in order to prevent them from declining their expert service.



Fig 5.



Fig 6.

#### DISCUSSION

The results can be interpreted from many angles through the impact of the above stated facts, as a result of the aging process, but also from the sociological and economic angle, that the third age population is dependent on the care of other persons. Those can be their closest or distant family members, but also experts if the patients are institutionalized in old people's home. Various systematic diseases will, to an extent, affect the condition of the stomatognathic system of the patient. Unfortunately, however, we have to state the truth about geriatric patients as they get older. Infrequently, if the geriatric patient is under the care of a younger person, or is immobile, confined to bed, the questions asked in communication with the medical aide, or the caregiver of an immobile person are always similar, or the same.

Geriatric prosthodontic remediation, as part of stomatological care, today involves an increasing number of third age patients.

#### CONCLUSION

This study raised a very important question, when it comes to the third age patients. Taking in consideration all the data presented, indications, contraindications, desires and possibilities of geriatric prosthodontic remediation, we have obtained a highly alarming fact that almost 50-65% of the patients were either partially edentulous with the remaining teeth untreated, or completely edentulous – geronto-prosthetically untreated.

Third age patients have to be treated with care from the reception and the first visit – by good communication, positive reception, appreciation of their own sense of suffering, interest in potential systematic diseases, and explanations of the procedures to be undertaken for solving their geriatric stomatological problems, obtaining the information on their prescribed medications, since it determines the type of anaesthetics used. This is all important for earning their trust and achieving ease of remediation procedure for the pathologies for which they sought medical help, either on their own, or through their caregivers. It is important to show concern about their health and their suffering. The most frequent problems are pain in a remaining tooth, which is either fractured or abraded, soft tissue abscess, or the most severe conditions (malignant diseases), found after thorough diagnostic procedures.

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## QUANTITATIVE AND QUALITATIVE ANALYSIS OF PRENATAL, POSTNATAL PRIMARY TEETH ENAMEL AND NEONATAL LINE

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Abstract: A special structure in the enamel is a neonatal line considered to be the result of a temporary delay in the development of the enamel during delivery and the adaptation of the body to extrauterine living conditions. The neonatal line thickness, observed on a light-electron microscope, is, on average, 12  $\mu$ m, measured on the extracted primary teeth of naturally born children. Since the development of the neonatal line is related to the moment of birth, in forensics and bioarchaeology this knowledge is used to examine the occurrence of infanticide as well as the time period that the child has spent in life.

Keywords: primary dentition, neonatal line, enamel formation

#### Introduction

In the prenatal life, periodic mineralization of all primary teeth begins. Due to periodic mineralization, incremental lines are formed in the enamel which reflects the effects of prenatal and postnatal factors on the child's organism [1]. Unlike permanent teeth, the development of the primary teeth begins with intrauterine life. Mineralization starts with primary incisors first, then on primary canines and molars. There is an obvious difference between the environment in which the primary and permanent teeth develop [2]. The enamel is unique in its properties which are influenced by the actual metabolic changes during tooth formation. SABEL 2008 Neonatal line is the first visible accentuated incremental line in the enamel and represents the border between prenatal and postnatal enamel. Prenatal and postnatal enamel differ in qualitative and quantitative properties [3]. This accentuated incremental line corresponds to the striae of Retzius. It extends in the cervico-incisal direction, and its average width, in children born naturally, is  $12\mu m$  [1,3]. This optical phenomenon occurs due to alterations in the height and degree of mineralization of the enamel prisms [1]. The neonatal line is the result of the stress caused by physiological or pathological factors [4]. It represents the biological mark of birth, the area of hypomineralization and pause in the development of the enamel. It forms during childbirth and makes the border between the prenatal and postnatal enamel [5]. The neonatal line is present in the enamel of all primary teeth and permanent first molars [1]. There are many factors that influence the characteristics of the neonatal line. It has been proven that prenatal factors and postnatal homeostasis affect the neonatal line thickness [6]. It is possible that the C-section, performed when there are complications in a natural delivery, has a different effect on the width of the neonatal line compared to elective C-section [3,6]. According to some authors, the mode of birth does not affect the neonatal line thickness ranging from  $15.9\pm5.74\mu m$  in natural birth and  $14.2\pm5.47\mu m$ in children born by C-section [7]. According to Eli et al. the neonatal line thickness in children born to C- section is lower in relation to those born naturally. This difference is explained by the smaller amount of stress the newborn is exposed to and the faster return to homeostasis [3].

In addition to the usual techniques for determining the age of an individual based on dental status and the development of teeth roots, it is aimed at improving new techniques to give more precise data. In addition to age assessment, the issue of fertility, duration of pregnancy and the nature of delivery is interesting. Applying contemporary methods poses the challenge of reconstructing life from a distant past, based on the neonatal line. Preparation and cutting of teeth samples for analysis is complex and requires great caution because it concerns human material that originates from prehistoric times, and can also be subject to judicial medical expertise [8].

#### **Samples preparation**

For the purposes of analyzing the characteristics of the neonatal line, it is necessary to collect extracted primary teeth, incisors, and canines, without signs of abrasion. After extraction, the teeth are stored in distilled water at +4 ° C, not longer than seven days. The crown of the teeth is cut by a dental low-speed handpiece (6000 rpm) in the vestibule-oral direction, with constant cooling with a water spray. For cutting purposes, a diamond disk is used (IsoMet 4000, Buehler, Dusseldorf, Germany). The samples for analysis are cut into a thickness of 150-200  $\mu$ m. After cutting, the polishing pattern of growing fineness of the samples (Smirdex Waterproof from P 400 to P 1600, Made in Greera) is followed.

#### Neonatal line underpolarisation microscope

The prepared samples were observed at a magnification of 20x and 40x. The neonatal line was presented as a continuous dark line in the gingival-cervical direction. The prenatal enamel was limited by the dentin-enamel junction and neonatal line, and the postnatal enamel was vestibular-orally in relation to the neonatal line (Figure 1). Depending on the software, it was possible to measure the width of the neonatal line.



Fig. 1. Primary Teeth Section Under Polarised Microscope. Magnification 20x and 40x. PoNE – Post-Natal Enamel, NNL – Neonatal Line, PrNE – Pre-Natal Enamel, DEJ – Dentin-Enamel Junction.

#### SEM and EDS analysis of prenatal and postnatal enamel

A scanning electron microscope equipped with a dispersive spectrometer (SEM / EDS) energy was used to test the qualitative properties of primary teeth enamel. The samples were placed in the SEM and observed at magnification from 50x to 100x. Using SEM, we analyzed the width of the neonatal line and width of the prenatal and postnatal enamel. Energy Dispersive X-Ray Spectroscopy (EDS or EDX) is a chemical microanalysis technique used in conjunction with scanning electron microscopy (SEM). By reading the results using the SEM TM3030 and the EDS Brukner software, data on the presence of microelements in the tooth cement: Ca, P, Mg, Sr, Zn, O2, F are obtained. Also, the Ca/P ratio could be calculated.





Fig. 2 Example of the SEM/EDS Analysis of the Primary Teeth Enamel. PoNE – Post-Natal Enamel, NNL – Neonatal Line, PrNE – Pre-Natal Enamel

#### Conclusion

Since the neonatal line is the subject of research of the three stated scientific disciplines (forensic, bioarchaeology, dentistry) from a different point of view, it is necessary to consolidate all the knowledge in these areas and to realize the dynamics of its formation during the development of a child. Additional knowledge of the anthropological characteristics of primary teeth, both in the ancient past and today, can be effectively applied in classical humanistic sciences and contemporary clinical disciplines.

#### Acknowledgment

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### **INTRAORAL SCANNERS-DIGITAL IMPRESSION**

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**Abstract:** Devices for taking direct optical impressions in dentistry which are based on creating a digital three-dimensional tooth virtual model in a quick and easy way, are intraoral scanners (IOS). The informations that digital models can provide at the beginning of treatment are inviolate and leads to much better diagnoses and even better quality of treatments. However, as IOS have been recently introduced commercially, they are not used frequently in everyday clinical practice. IOS that are current present onto the market are sufficiently accurate for capturing impressions in fabricating every prosthetic restoration and they are most often used for these purposes.

Key words: scanners, intraoral scanners, digital impression, optical impression

#### Introduction

Medical and dental practice undergone significant improvements with introduction of 3D (treedimensional) technology for the purpose of diagnosis and treatment of the patients. So called digital impressions using IOS is the first step in "digital flow" proceeding of prosthodontic treatment. Intraoral scanners (IOS) are devices for capturing direct optical impressions in dentistry [1–3]. As other three-dimensional scanners, they use a light source (laser or structured light) directing it onto the object to be captured. In dentistry objects usually are upper or lower dental arch, prepared teeth or implant scanbodies (transfers) [3, 4]. IOS come in several types, sizes and formates, which allows the recording of almost every part of the oral cavity. Some intraoral scanners are adapted for recording the frontal teeth, some for lateral teeth, and there are also those intended for use specially for children and specially for adults. Some of them have curved ending of the probe which makes easier recording the oral cavity from all angles, especially molars – Figure 1 (a, b, c, d).



Fig. 1. Types of intraoral scanners: a) iTero; b) 3Shape; c) 3M Espe; d) Cerec

#### The scanning process

Improved workflow results in a continuous process from the moment the shot was taken with an intraoral scanner. Mostly, it significantly reduces the time required to produce prints until delivery of the application, saves the time of doctors and patients. Digital workflow process, in contrast to the traditional one, has several steps less. After digital impression comes appliance design, then 3D (tree-dimensional) printing process and appliance delivery at the end. This implies that the communication between a dentist and dental technician is quick and simple and enables cooperation that saves time as well as resources - Figure 2.



Fig. 2. Digital workflow process

The 3D surface models of the dento-gingival tissues are the result of the optical impression and are the 'virtual' alternative to traditional plaster models [5, 6]. IOS are devices which are comprised of a manual camera (hardware), computer, and software. The aim of IOS is to capture with precision the three-dimensional geometry of an object. The images captured in oral cavity by imaging sensors are processed by the scanning software, which generates point clouds [4, 5]. The most widely used digital format is the open STL (Standard Tessellation Language) or locked STL - Figure 3(a). This format describes a succession of triangulated surfaces where each triangle is defined by three points and a normal surface. These point clouds are then triangulated by the same software, creating a 3D surface model (mesh) [4-6]. It is recommended that files are stored in open format. The reason for this is that each laboratory uses a different format. No matter what type of imaging technology IOS uses, all cameras require the projection of light that is then recorded as individual images or video and compose by the software after recognition of the POI (points of interest). The first two coordinates (x and y) of each point are evaluated on the image, and the third coordinate (z) is then calculated depending on the distance to object technologies of each camera - Figure 3(b) [6]. The main characteristic an IOS should have is an accuracy [1–9]. In metrics and engineering, accuracy is defined as the 'closeness of agreement between a measured quantity value and a true quantity value of a measurand', so the sum of trueness and precision is the accuracy and when the accuracy of IOS are testing both of caracteristics are evaluating [4–9].



Fig. 3. Creation of a STL file by an intraoral camera: a) STL file; b) sheme of calculation the third coordinate and generation 3D projection of virtual model

There are many dental tissues that can present reflective surfaces (enamel crystals or polished surfaces) that could disrupt the matching of POI by the software due to overexposure. To prevent this, clinicians can change the orientation of the camera to increase diffuse light, or use cameras with a polarizing filter [10]. For some scanners, a 20–40  $\mu$ m powder coating is required during the digitizing process to decrease reflectivity. The powder thickness could vary between operators and reduce file accuracy, but the software of the IOS is capable of calculating an average thickness into the measurement [11].

#### Advantages and disadvantages of optical impressions

The classic conventional impressions can often cause discomfort for the patient with strong gag reflex, or children due to the inconvenience and hardship stemming from the materials positioned in fabricated or special impression trays. Impression made by IOS decreases patient discomfort and eliminates the need for materials and impression trays and patient usually prefer digital scanning procces compared to the traditional one [12]. Digital impression allows the skipping of an inescapable phase in conventional impresson technique as making of physical impressions and casting of gypsum models with a huge time-saving effect. It translates into direct savings for the clinician and technican, with reduced consumables costs [3, 5, 7]. After performing the scan, the dentist can instantly e-mail it to the laboratory, the technician checks it and if not satisfied clinician can make another one without any loss of time. Patients usually feel more involved with optical impressions in their treatment and it is the easier way to achieve better communication with them as well as with technicians [3, 7]. The most frequent problems related with optical impressions is difficulty in detecting deep marginal lines on prepared teeth or scanning intraoral tissues in the case of bleeding. There is a learning curve for adopting IOS in the dental clinic, and this aspect must be considered with attention. Yonger dentist with a greater affinity for the technological improvements and computers will easer accept IOS in their practice, but older one with less experience and passion for digital innovations could find using the devices and related software more complicated [13, 14]. Like any other technological innovation, intraoral scanners and extra equipment have a high price and these devices are not very widespread in dental offices [2-4]. In the current literature most scientists considers the accuracy of optical impressions clinically satisfactory and similar but not better than conventional impressions in the case of single-tooth restoration and fixed partial prostheses of up to 4–5 elements [1, 4–9, 11] (Table 1.).

Advanages	Disadvantages
more comfort for patient	hard to detect deep margin lines bleeding barrier
saving time and resources	learning curve
simpler procedure	Cost
better communication between dentist, technicians and patients	same accuracy as conventional impresson

Table 1. Advantages and disadvantages of intraoral scanners (digital impressions)

#### Conclusion

Digital impression and digital process of dental restoration relative to conventional methods has many advantages and the most important one is that it is always the same regardless of the patient, while using the conventional methods this process varies and dependes of many factors. Advantages as saving time and materials are evidente, and simplification of the procedure and excellent comunication between the practitioner and patient as well as between clinician and technician are irreplaceable. Regarding to the prices of models obtained by conventional methods, the price varies and can be very high if the dentist has to make impression several times. With digital impressions, this is not the case because the tecnician can consult a dentist immediately after the first results and point out possible mistakes while the patient is still in the chair. Still, IOS also have disadvantages such as indications that are limited to small prosthetic restorations due to lower accuracy when it comes to big restorations and inaccessibility to certain details esspecially when the bleeding factor is present. The IOS currently available at the market vary in terms of accuracy, therefore, the latest-generation devices have wider indications for clinical use and they can not only be used in fixed prosthodontics to obtain the virtual models needed to manufacture a whole range of prosthetic restorations on natural teeth and implants, but also in implantology for guided surgery and in orthodontics. Inventioning an intraoral scanner of great precision and accuracy that would expose its indications to many dental branches would much facilitate further clinical practice, and considering the growth and development of technology it's possible and near.

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# Abstract Book Poster Presentations

## PREVALENCE OF EARLY CHILDHOOD CARIES IN LJUBOVIJA MUNICIPALITY AND IN BOR MUNICIPALITY

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#### Abstract:

Dental caries is the most frequent disease among children. It is multicausal, multistage, reversibile, infectious disease directly influenced by nutrition.Early childhood caries is a specific type of temporary teeth cacies wich develops very early and progrades quickly with frequent local and general complications. Dental caries treatment is very complex for the child and for the dentist as well, and requires good cooperation with parents. The aim of this research was to investigate prevalence of dental caries among infants and preschool children, and also to examine possible risk factors for dental caries occurencesuch as for example, the use of fluoride, bad socioeconomic status. The research was carried out as an analytical cross-sectional study. It included 167 children from the territory of Ljubovija Municipality, children of both genders aged 13 to 71 months. Dental caries diagnostics was determined by dental examination ( dental exlorer, mauth mirror ). The variation significance testing was carried out by the variance analysis and  $\chi^2$  test. Prevalence of early childhood caries in Ljubovija Municipality was 58,08%, and in Bor Municipality 37,33%. Kip in Ljubovija's nursery school was 2,82, and in Bor's nursery school 0.91. The high prevalence of early childhood caries in Ljubovija's and Bor's nursery school requires intesive prevention-prophylactic measures for children as well as for parents, reorganization of dental health care system as well as early diagnostics and treatment of early childhood caries.

Key words: Dental Caries; Preschool Child; Tooth Deciduous; Prevalence;

## TRANSMIGRATION AND IMPACTION OF MANDIBULAR CANINUS - SURGICAL TREATMENT

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#### Abstract:

Impaction refers to teeth which do not fully erupt into the mouth because of various factors: an irregular position of the germ, a limited jaw growth in the antero-posterior direction, fibrotic thickening of the mucoperiost, the presence of excessive and impacted adjacent teeth.

The incidence of mandibular canines impaction is less than maxillary and accounts to 0,44% of total cases.

Transmigration is a special type of impaction and represents the migration of unimaginative teeth over the median line, without the influence of the pathological etiological factor. However, it is extremely rare and occurs in 0.18% of total population.

This paper presents the case of a patient with an impacted and transmigrated mandibular canines and describes the procedure for treating the patient with the surgical extraction of these teeth.

## BITE WOUND OF UPPER LIP IN PATIENT WITH NEUROBORRELIOSIS – CASE REPORT

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#### Abstract:

Lyme disease is a severe, vector, bacterial disease of the central nervous system, skin and joints, caused by Borrelia burgdorferi. If this infectios disease is not diagnosed and treated in time, it can permanently damage affected organ systems.

From the clinic for ORL, a patient with an swelling of upper lip was sent. The patient is aware, immobile and do not communicate, she comes with her daughter. Heteroanamnestically, we receive information that patient has been suffering from a late fase Lyme borelliosis"Spastic quadriplegic cerebral paralysis. The clinical examination was accompanied by a spasm of hands, as well as an extreme spasm of the lower jaw muscules. Intraoral examination shoved that the cause of the swelling of the lip was, deep bite wound of upper lip, caused by the teeth of the lower jaw. Due to the lack of antagonists, as well as resulting trauma, teeth extraction in the intercanin region was indicated. General anesthesia for the preparation of the patient due to the underlying disease is not indicated by the anesthetist. The choice of therapy is tooth extraction with the use of local terminal anesthesia. Because of the impossibility of using the standard technic for extraction of the incisors, we have used an improvised technique, a combination of elevators and splines, in order to luxate and extract the teeth with minimal trauma. The patient was released half an hour after an intervention with a regular hemostasis.

Key words:Lyme disease, bite wound, teeth extraction.

## THE IMPORTANCE OF ORAL HYGIENE OF CHILDREN WITH HIGH MEDICAL RISKS

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#### Abstract: INTRODUCTION

Haemophilia is bleeding disorder in which the blood's ability to coagulate is impaired due to the lack of a coagulation factor. Haemophilia A is the most common type and any dental intervention can cause complications. Therefore, dentists take necessary precautions when it comes to patients with haemophilia and adequate preoperative care is given by hematologists. However, patients with mild haemophilia can undergo any dental intervention in usual way provided that their dentist knows the history of the disease.

#### **CASE REPORT**

Seventeen-year-old boy comes to The Dentistry Clinic. Patient complains about tooth sensitive to cold in the neck of lower cuspids and premolars on the vestibular side. On the basis of clinical examination, white spots on teeth are noticed and also early stage enamel caries on cervical thirds of vestibular surfaces of the upper and lower jaw. Through anamnesis, it is found that he drinks a lot Coca-Cola every day. First, dental plaque is removed. Then, plexus anesthesia is given while class V lesions are treated. The patient is given advice about oral hygiene and on a balanced diet.

#### CONCLUSION

Every procedure in oral cavity can lead to haemorrhage, and considering that caries and gingivitis can be prevented, all the necessary precautions must be taken. It implies practicing and maintaining good oral hygiene, using dental products that contain fluoride, filling dental fissures, advice on eating a balanced diet and regular dental checkups every 3-6 months.

## THIRD AGE PATIENTS BEFORE AND AFTER REMEDIATION BY PROSTHODONTIC PROCEDURES

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#### Abstract:

#### Introduction.

Republic Serbia, with its approximately 16% of the population over 65, is demographically ranked among the countries with the oldest population in the world. This impose a demand on all of us to comprehensively observe a population that is increasingly numerous and more accessible to all types of health care and therefore dental health care.

#### The aim of the study.

The main goal of this study was to determine the of patients of the third age before and after stomatoprosthetic remediations.

#### Methodology.

In this paper, the applied research was done according to the principle of selection of patients (thirdlife), with their consent to participate in this study. The therapeutic protocol sanations was the same for all patients stratified by age.

#### Results.

All the results obtained during this study are presented, although in the professional public it is a wellestablished practice to present only successful and positive results of individual research. We rarely can read those less successful results - unwanted for publication. All results will be tabulated and graphically presented in lecture, and on paper in extenso.

#### Conclusion.

This study raises a very important question when it comes to patients of the third age. When we take into account all the above data, indications, contraindications, desires and possibilities for gerontoprostethic rehabilitation, we can freely say, worrying that almost 50-65% of patients - examinees were partially or completely edentulous and gerontoprothetically untreated.

Key words: Prosthodontics, Stomato-prosthetic remediation, Geriatric dentistry

## ADHESIVE BRIDGE AS CHILDREN'S CONDITIONALLY PERMANENT SOLUTION FOR LOSS OF PERMANENT TEETH

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#### Abstract:

**Introduction**: In young age, in case of absence anterior teeth, when implantation is not desirable because of incomplete growth of bone structures, and the fixed prosthetic work is avoided in order to preserve the healthy tooth tissue of the agonist tooth, we induse the construction of an adhesive bridge. This type of compensation is used to close the space between the individual teeth, but only if the teeth are agonists, who hold the bridge on both sides, periodontally healthy and without large fulfillments. Adhesive bridges can be made from composite materials based on fiber fibers (directly cavity) from non-metallic ceramic or acrylate in the art.

**Case Report**: A patient,13 years old, appears at the Dental Clinic of Vojvodina, due to swelling and pain in the teeth area 11. By dental examination and analysis of the OPT image, we find that it is necessary to remove the tooth 11 due to the failure of the treatment of chronic periodontitis and swelling. Since the adhesive bridge is an ideal solution for such cases, it is made as a temporary or conditionally permanent solution for dental compensation. The method is painless, it can be performed without anesthesia and everything can be done just in one visit. Aesthetics is very satisfactory, even in the most demanding situations.

**Conclusion**: Prosthetic compensations must not interfere children's growth and development of the orofacial system, but to direct it and preserve oral tissues by the time it is possible to design a permanent prosthetic replacement. Adhesive bridges allow functional, aesthetic and biological rehabilitation for children's orognat system, so that the healthy tooth tissue of the carrier is preserved and prevented the resorption of the ridge and the migration of the teeth.

Key Words: Adhesive bridge, fiber fibers, composite

## SURGICAL EXTRACTION OF MANDIBULAR THIRD MOLARS IN PATIENT WITH VON WIELLEBRAND DISEASE

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#### Abstract:

Von Willebrand's desease is the most common bleeding disorder affecting up to 1% of the world's population. The central feature of the desease is an abnormality in von Willebrand factor, either quantitative or functional.. Clinically manifested by bleeding from the mucous membrane, frequent epistaxis, menorrhagia, while bleeding in the joints and muscles is present only in severe forms of the disease.

Patient with Von Willebrand desease was referred by a nearby medical centre to the Department of Oral Surgery at the University School of Dentistry in Novi Sad, for surgical extractions of mandibular third molars . Consultation with the patient's hematologist is required to ensure preoperative prophylactic coverage. After full clinical and radiographic evaluation, extractions of impacted teeth were planned to be performed procedures under local anaesthesia. Mucoperiostal flap was reflected into the fornix. Both mandibular third molars were extracted. The flap was placed on its original position and sutured. The sutures were removed after seven days.

Key words: oral surgery, von Willebrand desease, haemostasis

## THE REASONS FOR REPORTING TO THE FIRST DENTAL VISIT -COMPARATIVE ANALYSIS OF THE THREE SUCCESSIVE FOUR -YEARS PERIODS

## Pavlović Trifunović Lj.<sup>1</sup>, Galović J.<sup>1</sup>, Vukojević T.<sup>1</sup>, Perin M.<sup>2</sup>, Nikolić Ivošević J.<sup>3</sup>, Blagojević D.<sup>4</sup>, Petrović B.<sup>4</sup>

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#### Abstract:

*Background:* The first dental examination in the early age provides education and motivation of parents for proper nutrition, regular and proper oral hygiene in order to form positive habits in order to preserve and improve oral health in the child.

*Aim:* The aim of the research was to comparate the change in the reasons why parents bring children to the first examination of a dentist.

*Design:* Data on the reasons for the first meeting of children with a dentist were analyzed. In the first observed period, 2004.-2008. Were included 150 children, and in the second 2009.-2013., 120 children, in the third, 2014.-2018., 118 children. The used data werw obtained from the medical documentation of the Health Center Novi Sad.

*Results*:Analysis of the obtained data showed that in the period 2004.-2008. the reasons for the first meeting were 63,8% preventive, and in 36,2% of cases due to already existing problems. In the second evaluation period 2009.-2013., the results are as follows : the first meeting with a dentist was 72,1% for preventative reasons and 27,9% for already existing problems. In the third period , 2014.-2018., the first meeting was in 77,3% for preventative reasons , and in 22,7% due to already existing troubles.

*Conclusion*: On the basis of the obtained results we can conclude that the consciousness of the parent of infants and young children about the importance of preventive dental examinations in the earlier age has increased. In order to keep it gooing it is necessary to continue and intensify health education wizh parents , as well as cooperation with a pediatrician and gynecologist, in terms of education pregnant women on the importance of maintaining oral health of the cavity to prevent bacterial vertical transmission , with the aim of increasing the involving of infants for the first preventive dental examination.

## IMPORTANCE OF USING PROBIOTICS IN CHILDREN DENTAL CARIES PREVENTION

#### Nešković I.<sup>1,2</sup>, Brakoč J.<sup>1</sup>, Blagojević D.<sup>1,2</sup>, Vujkov S.<sup>1,2</sup>, Petrović B.<sup>1,2</sup>

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#### Abstract:

The mechanism of probiotic activity is still a subject of many researches. Probiotic species competitively inhibit the formation of toxic substances and the growth of less desirable species by occupying their space for colonization and nutrition. In dentistry, a probiotic with a very important role is Lactobacillus rhamnosus GG. It is considered to reduce cavity prevalence in children and to have a positive effect on oral health.

Examining the outcome of yoghurt with Lactobacillus rhamnosus GG (B-Activ LGG, Dukat) on the acumulation of dental biofilm. To prove that probiotic lactic products, containing Lactobacillus rhamnosus GG, have an important role in caries prevention.

This study involved 25 children, whose plaque index (Silness- Löe) and salivary pH (pH-Fix-0-14, Macherey-Nagel) were measured before and after a 14-day consumption of 200ml of yoghurt with Lactobacillus rhamnosus GG (B-Activ LGG, Dukat).

The average value of salivary pH before consumtion of the yoghurt was 6.32 and after the two week consumption of the yoghurt it was 6.84, which shows us an increase of the pH level. On the other hand, a decrease in the amount of dental biofilm was expected, which the results prove (the average value of the plaque index before consumption of the yoghurt was 0,81 and the average value after 0,26).

Regular consumption of the Lactobacillus rhamnosus GG enriched yoghurt affects the acumulation of the dental biofilm and the increase of the salivary pH and indirectly effects the S. mutans level.

Keywords: lactobacillus rhamnosus GG; caries prevention; probiotics

## HIPOMINERALIZATION OF PERMANENT TEETH AMONG TWELVE-YEAR-OLD CHILDREN IN NOVI SAD

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#### Abstract:

**Background:** Hypomineralization is a globally raising problem, that is not completely understood. It is an idiopathic developmental irregularity of the enamel structure. It presents with a different opacity and porosity of the enamel. There is not enough data on hypomineralization in Serbia. The aim of this study was to evaluate the prevalence of hypomineralization and dental status in general, among 12-year-old children in Novi Sad, Serbia.

**Method:** The study was held at the Department of Pediatric and Preventive Dentistry of Health Centre Novi Sad in the period from December 2018 untill February 2019. The sample consisted of 57 children, age  $12 \pm -6$  months, of both genders. Dental status was registered, with special focus on teeth with hypomineralization.

**Results:** There were 16% of children that had hypomineralization. Among children affected with hipomineralisation, the average number of teeth with hypomineralization was 4. The highest recorded number per child was 16. There were 22.8% of caries-free children. DMFT index (sum of decayed, missing and filled teeth) of this population was 2.4. There were 50% of children with active caries, 58% of children with fillings and 3.5% of children with extracted teeth. There was no significant difference between boys and girls.

**Conclusion:** Hypomineralization problem in Serbia should be further investigated. DMFT-12 index for Novi Sad is 2.4, which means that this is a population with low DMFT. However, it is still higher in comparison with more developed countries in EU, where DMFT-12 is lower than 1.2.

Key words: hypomineralization, caries, children

## ASSESSMENT OF GINGIVAL BIOTYPE: A COMPARISON OF VISUAL AND DIRECT METHODS

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#### Abstract:

**Introduction:** Gingival biotype is a descriptive parameter of the gingival thickness in the buccooral dimension. Significance of the gingival biotype assessement is in a fact that this parameter has a important impact in a consecution of the periodontal disseases and on the outcome of the numerous dental interventions.

Aim: Aim of this study was to estimate a frequency of various gingival biotype in examinated sample and to evaluate reliability of non-invasive visual methods for determination of gingival biotype compared with direct method.

**Material and methods:** Gingival thickness was examinated in 44 patients with present natural upper central incisors, without simptoms of periodontal disseases. Gingival biotype was assessment in region ofmaxillar incisors: visual, transgingival probing method and direct method. At direct method gingival biotype was considerd as thick if the thickness was  $\geq$  1,2mm and thin if it was < 1,2mm. Composition of methods was made by McNemar's test and Cohen's Kappa coefficient.

**Results:** Average thickness of gingiva in examinated sample was  $1,30\pm0,21$ mm (measured with direct method). Significantly thicker was gingiva of examinated male patients F(1, 42)= 4,218, p=,046. By ground of all three ways of assessment in sample was more common thin gingival biotype (visual n=35/88; trangingival n=43/88; direct measuring n=34/88). McNemar's test and Cohen's Kappa coefficient was determinated that there was no significant difference in assessment of gingival biotype between visual, trangingival and direct method

Conclusion: Noninvasive, visual methods are reliable way for gingival biotype assessment.

*Key words:* gingival biotype, reliability of visual method, transparency of the periodontal probe, digital caliper.

### **CURRENT CLASSIFICATION OF ENDODONTIC DIAGNOSIS**

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#### Abstract:

In the past, diagnosis of pulpal and periapical diseases was usually related to histopathological findings which often had little or no correlation with clinical symptoms. Nowadays, in order to determine proper clinical treatment, a clinical signs and symptoms was set as a basic findings, and according to that, a current classification of endodontic diagnosis was determined. This classification defines pulpal and periapical diseases.

Pulpal diseases include:1) Normal pulp, which is define as clinically symptom free and normally responsive to pulp testing; 2) Reversible pulpitis, condition with mild inflammation in the pulp that will heal when irritant is removed (caries, exposed dentine). Patient feels transient discomfort when stimulus such as cold or sweet is applied; 3) Symptomatic irreversible pulpitis is an inflammatory process where pulp is incapable of healing and root canal treatment is indicated. It is characterised by prolonged pain on thermal stimuli and spontaneous pain, but no discomfort to percussion; 4) Asymptomatic irreversible pulpitis is also irreversible inflammation of the pulp, but clinically asymptomatic. Root canal treatment should be provided; 5) Pulp necrosis is asymptomatic and non-responsive to pulp testing, necessitating root canal treatment.

Periapical diagnosis are classified as: 1) Normal apical tissues, where radiographically lamina dura and periodontal ligament are intact and there is no sensitivity to percussion; 2) Symptomatic apical periodontitis is inflammation of the periapical periodontium, producing spontaneous pain and discomfort on biting and percussion, usually with no radiographic changes; 3) Asymptomatic apical periodontitis is clinical asymptomatic condition with radiographic apical radiolucency; 4) Chronic apical abscess is an inflammatory reaction to pulp infection where abscess is draining through sinus tract, followed with no clinical symptoms; 5) Acute apical abscess is characterised with rapid onset, severe spontaneous pain, sensitivity to percussion, swelling, systemic manifestations and no radiographic signs. All periapical diagnosis necessitate root canal treatment or extraction.

Key words: endododontic diagnosis, classification, pulpitis, apical periodontitis

## THE USE OF DEEPITHELIALIZED EPITHELIUM-CONNECTIVE TISSUE GRAFT IN THE TREATMENT OF GINGIVAL RECESSION

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#### Abstract:

Gingival recession treatment is one of the most complex challenges in mucogingival surgery. To date, procedure involving a combination of connective tissue graft (CTG) with laterally or coronally displaced flaps has been shown to yield the most optimal outcomes. In dental practice, trapdoor, Langer L and envelope techniques are typically used for obtaining tissue graft from the palate. However, their application significantly extends the intervention

duration, resulting in patient discomfort and postoperative pain. Moreover, these techniques necessitate palatal mucosa of certain thickness to avoid necrosis at the donor site. Consequently, some authors propose use of deepithelialized epithelium-connective tissue graft.

#### AIM:

The aim of this work was to report on gingival recession treatment involving deepithelialized epithelium-connective tissue graft in combination with coronally displaced flaps.

#### CASE REPORT:

A 23-year-old male reported to the Clinic for Dentistry of Vojvodina presenting with gingival recession. Clinical examination revealed Class II gingival recession based on Miller classification of 4 and 5 mm vertical dimensions, involving teeth 23 and 24, respectively. Epithelium-connective tissue graft obtained from the palatal region of teeth 25 and 26 was deepithelialized extraorally before being placed on the previously planed exposed roots of the two affected teeth and finally covered by coronally displaced flaps. The donor site was protected by covering it with gelatin sponge secured in position with crisscross sutures. Postoperative period was uneventful and the roots of affected teeth were fully covered at 1-moth follow-up.

#### CONCLUSION:

Deepithelialized epithelium-connective tissue graft technique can be successfully applied to treat single or multiple gingival recession sites. The procedure is shorter and less invasive, thus decreasing patient discomfort, while yielding connective tissue of superior quality, as tissue harvesting is performed at the posterior segments of the hard palate characterized by lower adipose and glandular tissue content. In addition, the tissue utilized in this procedure is located directly beneath the epithelium, and is therefore denser and more stable, due to which shrinkage during healing and maturation is reduced, contributing to a greater treatment success.

Key words: gingival recession, connective tissue graft, deepithelialized graft

## TOOTH DEFORMATION ANALYSIS DURING POLYMERIZATION OF NANOCOMPOSITES BY USING DIGITAL HOLOGRAPHY

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#### Abstract:

The stress generated during polymerization of dental composites is transferred to the toothrestoration interface and can cause cuspal deflection or formation of marginal gaps on the adhesive bond. For the testing purpose of these biomechanical parameters, digital holography (DH) as a noninvasive technique was proved to be very suitable.

The aim of this study was to assess tooth tissue deformation during polymerization of contemporary dental nanocomposites by using DH in "*in vitro*" conditions.

The research was conducted at the Institute of Physics in Zemun using a custom-made holographic set-up with a laser adjusted at 532 nm wavelenght. The specimens of molars, with a first class cavity, were cut in half in the vestibulo-oral plane. The cavities were filled with Filtek Ultimate Universal® nanocomposite and light-cured for 40 seconds with SmartLite IQ2® LED curing lamp. Assessment of the polymerization dynamics was done indirectly, by measuring tooth deformation for 5 minutes from the begining of photoactivation. Deformation is presented as a series of interference lines ("fringes") superposed on the holographic image. Period, shape and orientation of fringes give information about specimen's deflection.

The obtained results reveal cuspal deflection (buccal and palatal) in the photoacivation period, but also during the post-photoactivation period. At the end of the examined period, an average tooth deformation was 3-5  $\mu$ m. During the first minute, there was a linear deformation increase along with continuous deformation after the end of light-curing cycle. Even though deformation reaches its maximum at the end of the first minute, ongoing changes in shape and orientation of fringes indicate active polymerization dynamics until the end of examined period.

A clear insight into the polymerization process of contemporary dental composites is fundamental for understanding their clinical characteristics and represents a reference point for their further development.

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Key words: dental composites, polymerization shrinkage, digital holography
## **USE OF RUBBER DAM IN EVERYDAY DENTAL PRACTICE**

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#### Abstract:

The rubber dam is a thin, rubber latex or nitrile rubber used in dentistry to isolate one or more teeth from the oral cavity during the dental intervention. The main role of rubber dam is isolation, or the prevention of saliva, that compromises dental intervention by preventing microorganisms from penetrating the mouth of the cavity during endodontic treatment, to provide a dry working field when placing the fill on the teeth and to prevent aspiration or ingestion of instruments and materials.

Setting up a rubber dam is very simple and painless. Before placing the rubber dam, it is necessary to prepare the teeth by removing calculus and dental plaque. Proper choice of dam and clamps will provide adequate isolation and preparation of the working field. When the technique is overcome, the procedure itself does not take much time and provides adequate protection for both the patient and the therapist. Patients do not have a negative attitude to the use of rubber dam but are affected by the experience and skills of the therapist itself.

The use of rubber dam in everyday dental practice makes work easier, increases the effectiveness of therapy and should be a standard procedure as part of the patient's oral health care.

Keywords: isolation, rubber dam, daily dental practice

## NOVEL TRENDS IN ROOT CANAL IRRIGATION PROCEDURES

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#### Abstract:

Efficient irrigation is one of the key factors for succesfull outcome in endodontic therapy. Although irrigants are well known, different protocols and irrigant sequencing are still being examined.

Sodium hypoclorite is considered the "gold standard" endodontic irrigant and it is very efficient in combination with mechanical instrumentation for primary endodontic infections. Novel trends are directed towards examinating different additional irrigation protocols to improve canal disinfection, when persistent infection in a form of biofilm (E. faecalis, C. albicans) is present on root canal walls and in dentinal tubules. Review of current literature states that in these situations, in combination with irrigant, passive ultrasonic or sonic irrigation can be successfully applied; the use of instruments such as XP-endo Finisher or Self Adjusting File; also irrigation with Navitip FX- specially designed plastic needles covered with bristles used for irrigation with simultaneous scrubbingcan be used. These procedures have one common goal-to provide supplemental cleaning with brushing action and irrigant movement, in order to eliminate the biofilm that contains bacteria, resistant to standard irrigation protocols. Also, these additional procedures are decreasing the need for extensive dentin removal, improving root canal strength.

The most recent examinations are made with the use of biocompatible nanoparticles with ability to retain to the biofilm and catalyze the chemical reaction of disinfection. Also there is a potential use of similar nanoparticles as a good option for an intracanal medicament. The application of these modern scientific knowledge in everyday clinical practice can significantly increase the effectiveness of nonsurgical endodontic treatment.

Key words: irrigation, endodontic treatment, disinfection, biofilm, bacteria

# EVALUATION OF THE KNOWLEDGE OF PARENTS ABOUT THE BEGINNING OF ORAL HYGIENEAND THE IMPACT OF THE NUMBER OF MEALS ON ORAL HEALTH OF CHILD

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#### Abstract:

AIM:Estimate and analyze knowledge of parents of oral hygiene and the impact of the number of meals on oral health of child.

MATERIALS AND METHODS:Project of the Health Center Novi Sad "My mom knows and I know" was realized in the period september – decemberduring three consecutive years (2016-2018.), through the input test, health education with 1,850 parents and preventive dental examination of infants and young children (0 to 3 years) pointing to the importance of the first preventive examination all of its goals. After the completed output test parents were given written instructions – flyers. This was a cross-sectional questionnaire-based survey.

RESULTS: The analysis of the data obtained from the entrance test for three years suggests that 36.7% of childrenat risk of developing the disease due to the lack of awareness of their parents about the importance of early onset of oral hygiene. The percentage of children at high risk for the disease was significantly reduced (in 2016, 19% of children had a high risk, 15% in 2017.), so that in 2018. there are no children with a high risk of disease related to the onset of oral hygiene. In 2018, the percentage of children at risk of developing disease due to lack of awareness of parents about the effect of nutrition on oral health is 42%, which is 5% less than the previous two years. The analysis of the outcome test for three years showed that 94.7% of the parents adopted knowledge through placedhealth education.

CONCLUSION: The project established the state of oral health of children under 3 years of age, knowledge of parents of the importance of regular and proper nutrition and the and regular maintenance and proper oral hygiene, education was carried out which contributed to the overall goal of improving the oral health of children.

Key words: oral health, children, oral hygiene, knowledge, parental

# DESIGN OF MICROFLUIDIC PVC CHIP BASED SYSTEMS FOR SALIVARY DIAGNOSTICS

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#### Abstract:

A growing interest has been observed in finding less invasive diagnostic tests, which has intensified research investigating the possibility of salivary use as a diagnostic fluid. The aim of this study was to assess the microfluidic properties of salivary specimens, the possibility of mixing with antiseptic solutions, viscosity and basic physical properties of liquids within the channel of PVC microchips. In this study, distilled water, artificial saliva and saliva from 4 volunteers, participants of the study, were analyzed. 12 PVC chips were made out of which 3 were used for analysis of distilled water, 3 for determination of artificial saliva parameters, 3 for unstimiluated saliva and 3 for stimulated saliva analyses. The chips were Y-channel chip without any obstacles. The input channels were set at an angle of 60 °. The channel width was 500-700 µm. The analyzed parameters included the passage, speed and necessary pressure for the laminar flow of liquids. The liquid diffusion was observed with a USB camera. For the visualization purposes, the tested fluids were painted with gentian violet. All chips were passable for all tested microfluidic systems. A laminar flow of water was achieved by pressing 55 mbar, while saliva required a pressure of 70 mbar. The smallest pressure on which flow is possible is 5 mbar for water, and for saliva 10. The results suggests that salivary biomarkers analyses for everyday use in clinical practice employing PVC based microfluidic systems require additional confirmation, standardization of collection and the development of sophisticated analytical methods.

Key words: saliva, diagnostics, microfluidics, chip

# INFLAMMATORY ROOT RESORPTION AFTER TEETH AVULSION - A CASE REPORT

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#### Abstract:

According to the definition trauma is violent damage of the body, caused by external factors. Teeth injuries in children occur at a time of intensive physical and psychological development, which particularly complicates clinical picture, diagnosis, therapy and prognosis outcome of injured teeth.

Complications after injury are numerous and very frequent. They depend on the severity of the force and the type of injury. Inflammatory root resorption is the complication wich most commonly occurs after luxation, avulsion and fracture of the teeth. The formation of resorption depends on the time since tooth decay up to replantation, from the way and the technique of care. External and internal root resorption could be distinguished. External resorption is more frequent than internal, and most commonly develope without any clinical symptom, which requires more frequent radiographic control.

This paper presents the case of a girl aged 9 years. Based on the anamnesis, it was found that a 7-yearold child fell at school, at a time of physical, with a tooth avulsion 11 and 21. The clinic reported an hour later, with teeth being contaminated with dirt. Teeth replantation was done, and the teeth were fixed with composite splint. On the OPR was found that in the teeth 11 and 21 the root growth was not completed. Also, by analyzing the image, the tooth hypodontion of teeth 12 and 22 was diagnosed, which further complicated the clinical picture. After two weeks, during the controle visit, it was determined that the teeth were fixed, with the composite splint was removed. After a week, the patient appears for pain. The analysis of the RTG record showed the signs of acute apical periodontitis, the endodontic treatment of the teeth 11 and 12. The root canals filled with sterile calcium hydroxide. The patient reported to the Clinic after 2 months due to luxation of the teeth 11 and 21, a RTG record was performed and a pathological inflammatory root resorption was diagnosed. The composite splint is set again, the teeth were filled with sterile calcium hydroxide.

#### Conclusion

Pathological root resorption represents the most severe complication following tooth avulsion. The prognosis of this complication is very bad. In this case, the present hypodontia of the teeth is significantly influencing by the further treatment plan.

# MINIMALLY INVASIVE ACCESS CAVITY IN ENDODONTICS: WHEN, HOW AND WHY?

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#### Abstract:

One of the most common causes of failure of endodontic therapy is tooth fracture due to insufficiently preserved dental tissue. In the past few years, in accordance with the concept of "minimally invasive dentistry", a minimal invasive (conservative) method of preparation of access cavity has been introduced. The minimally invasive access cavity can be realized if it is possible to visualize the whole pulp chamber floor, identify all canal orifices, remove obstructions and three-dimensional clean the canal system. Indications for conservative access cavity preparation are: teeth with minimal occlusal caries, class V cavities, aproximal cavities, traumatized teeth or teeth exposed to unfavorable occlusal stresses, teeth under prosthetics crowns and bridges and teeth indicated for endodontic therapy from prosthetic reasons. In addition to the necessary knowledge and clinical experience, the use of modern technologies such as: dental operative microscope, ultrasonic tips for use in endodontics, machine-driven nickel-titanium files and activators of intracanal irrigation are necessary to achieve minimal invasive access cavity. A conservative endodontic approach is not complicated procedure if, with adequate knowledge and experience, the protocol of endodontic therapy is respected and modern technologies are used.

Key words: endodontic therapy, minimally invasive dentistry, minimally invasive access cavity

# DISCUSSION OF EARLY CHILDHOOD CARIES IN CHILDREN ON THE TERRITORY OF THE MUNICIPALITY OF SRBOBRAN

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#### Abstract:

Early Childhood Caries (ECC) is a specific, acute form of milk teeth caries that rapidly progresses and involves a large number of teeth, resulting in crown destruction and numerous local and general complications. The aim of this study is to present the prevalence of ECC with children aged between 13 - 71 months in the territory of Srbobran municipality. The survey was carried out as an analytical section study and included 479 children. Dental examination was performed in a dental clinic, with artificial lighting, visual-tactile method, using a mirror and a probe. The significance of the difference was analyzed by the X<sup>2</sup> test (p <0.05). The prevalence of ECC was 34.45%. The average number of diseased teeth increases with increasing years of child's life and ranges from 0.05 to 4.7. ECC is more common in girls, and molars are the most affected group of teeth. The high prevalence of ECC points to the need for a serious reorganization of dental care program in our country.

Key words: milk teeth, caries, pre-school child, prevalence

# PLASMA CELL GINGIVITIS ASSOCIATED WITH GINGIVAL HYPERPLASIA IN A KIDNEY TRANSPLANT RECIPIENT

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#### Abstract:

**Introduction:** Plasma cell gingivitis is a relatively rare disease that usually involves the anterior maxillary and mandibular gingiva. It manifests as extreme redness, sometimes accompanied by gum tissue enlargement. While the disease etiology remains unclear, its presentation is mostly attributed to non-specific inflammatory reaction to certain foodstuffs or ingredients in oral hygiene products. In patients that have undergone kidney transplant, and are thus continually receiving immunosuppressive therapy, gingival hyperplasia is common. The incidence of hyperplasia is significantly higher if the patient is also taking drugs from the group of calcium channel blockers.

**Case report:** A 18-year-old patient reported to the Clinic for Dentistry of Vojvodina presenting with gum tissue enlargement. Twelve years ago, he had a kidney transplant and had since been receiving cyclosporine as immunosuppressive therapy, while also taking drugs from the calcium channel blocker group. Intraoral examination revealed increase in marginal and interdental gingiva, especially in the area of the upper anterior teeth, associated with a purple red lesion clearly demarcated from the surrounding tissue in the region of tooth 22 and teeth 33 and 34. Following nonsurgical periodontal therapy, the hyperplastic gingiva in the area of the upper anterior teeth was surgically removed. Patient was advised to replace the toothpaste intended for adults with that aimed at children, as well as to discontinue chewing gum and herbal spices consumption. The pathohistological results supported the plasma cell gingivitis diagnosis. At the control visit, the clinical picture in the lower jaw remained unchanged.

**Conclusion:** Since elimination of likely causative agents of plasma cell gingivitis failed to yield any improvements, the lesions could likely be attributed to the immunosuppressive therapy. Changes require further monitoring and determination of the etiological factors. This is the first case of plasma cell gingivitis associated with hyperplasia induced by medication.

Key words: plasma cell gingivitis, gingival hyperplasia, kidney transplatation